MODERN PLASTICS

NOVEMBER 1960

PHOTOGRAPHED FOR MODERN PLASTICS BY RUDY MULLER

THIS IS CHEMAGINATION


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*

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NOVEMBER 1960
Volume 38 Number 3

PLASTICS*

Coming Up . . .

The important contributions plastics films are making as engineering materials in a wide range of end-use industries—*other than packaging*—is the subject of our December lead . . . New method of mold making represents a real break-through in tool production . . . How to design molded parts for best vacuum metallizing results . . . How plastics are starting to invade the small-arms ammunition market . . . Why vinyl sheet, film, and coatings are making such good progress in the construction field . . . Also in the works: fluorescent pigments for plastics . . . Penton parts for pumps . . . and our expanded January statistical review of materials and machinery.

ABC
ABP
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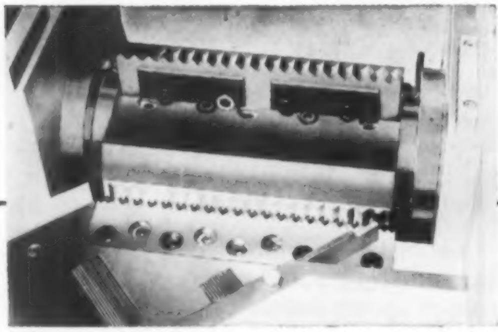
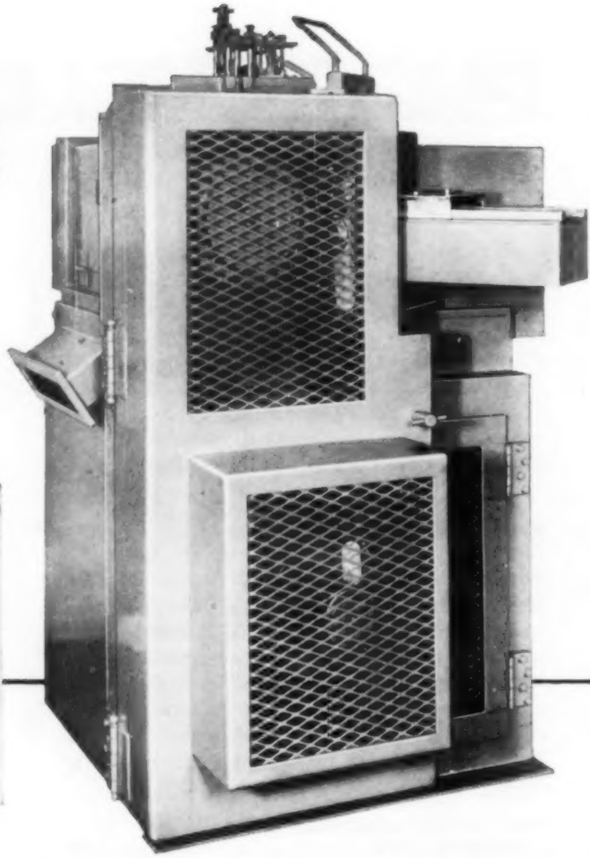
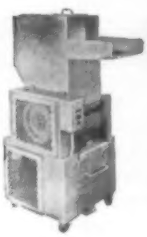
Cumberland
"Stair-Step" DICING MACHINE



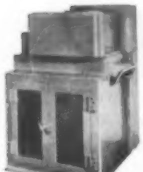


PART OF THE COMPLETE LINE OF CUMBERLAND PELLETIZERS, BESIDE THE PRESS AND CENTRAL GRANULATING MACHINES, DICERS, CHOPPERS AND PRE-BREAKERS



LARGE THROAT GRANULATORS

Minimum floor area needed. Five new throat sizes available. 7"x10", 8½"x12", 8½"x16", 12"x16", 12"x20".



CUMBERLAND PELLETIZING MACHINE

New feed roll mechanism provides better control of extruded strands of plastic materials. Cuts cubes or pellets 1/32" to 1/2". 14" and 24" openings.

PERFECT RESULTS Exclusive 45° feed produces perfect cubes or rectangle pellets in sizes 1/16" to 1" in one severing operation — rotor knives cutting against one stationary knife.

VERSATILITY Dices wide range of extruded or milled thermoplastic ribbon, or sheet stock. TWO standard sizes to accommodate 7" or 14" stock. Special sizes built to order.

QUALITY CONSTRUCTION Ruggedly built. All surfaces contacting plastics materials are of corrosion resistant metals, stainless steel or chromium plated.

Watch for future ads featuring other outstanding Cumberland machines, and write for Bulletin 590.

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316-7

Another new development using

B.F.Goodrich Chemical *raw materials*

New Push-Button Heating Pads by General Electric have five parts made of Geon shown in inset: (1) inner cover; (2) cordset; (3) T-Connector; (4) tube which contains thermostat; and (5) heater wire insulation. B.F.Goodrich Chemical Company supplies the Geon vinyl.

How heating pads get "most wanted" features from different Geon vinyls

Waterproof. The manufacturer of these heating pads says they "make wet pack applications a cinch." The reason? Their inner cover is made of film extruded of Geon vinyl. It is tough, abrasion-resistant and waterproof.

Convenient. Three thermostatically-controlled heats are at fingertip in a push-button switch with a cordset which is accurately molded of another form of Geon vinyl. The thermostat connections are enclosed in tubing made of a similar impact-resistant, rigid-type Geon. These vinyls are white—could be any color.

Safe. All the wiring inside the heating pad is insulated with still another Geon vinyl. Geon provides excellent dielectric properties and good resistance to abrasion, weathering and heat, as well as being unaffected by corrosion.

Here is an excellent example of the way one manufacturer uses different Geon resins and compounds to improve a product. For more information, write Dept. GJ-11, B.F.Goodrich Chemical Company, 3135 Euclid Avenue, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

Geon VINYLS

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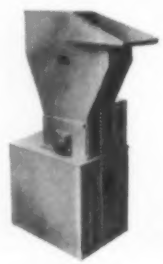
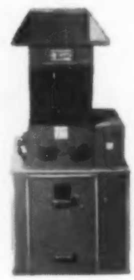
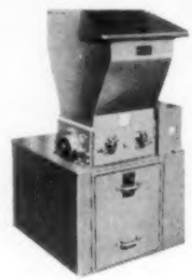
75 pounds/hour
8" x 6" throat



M-100
200 pounds/hour
8" x 8" throat



M-200
300 pounds/hour
8" x 12" or 12" x 12" throat



M-300
400 pounds/hour
8" x 16" or 12" x 16" throat

For beside-the-press or batch grinding, B & J Marvel Series Granulators are your best buy. Why not see for yourself? Write for catalog.

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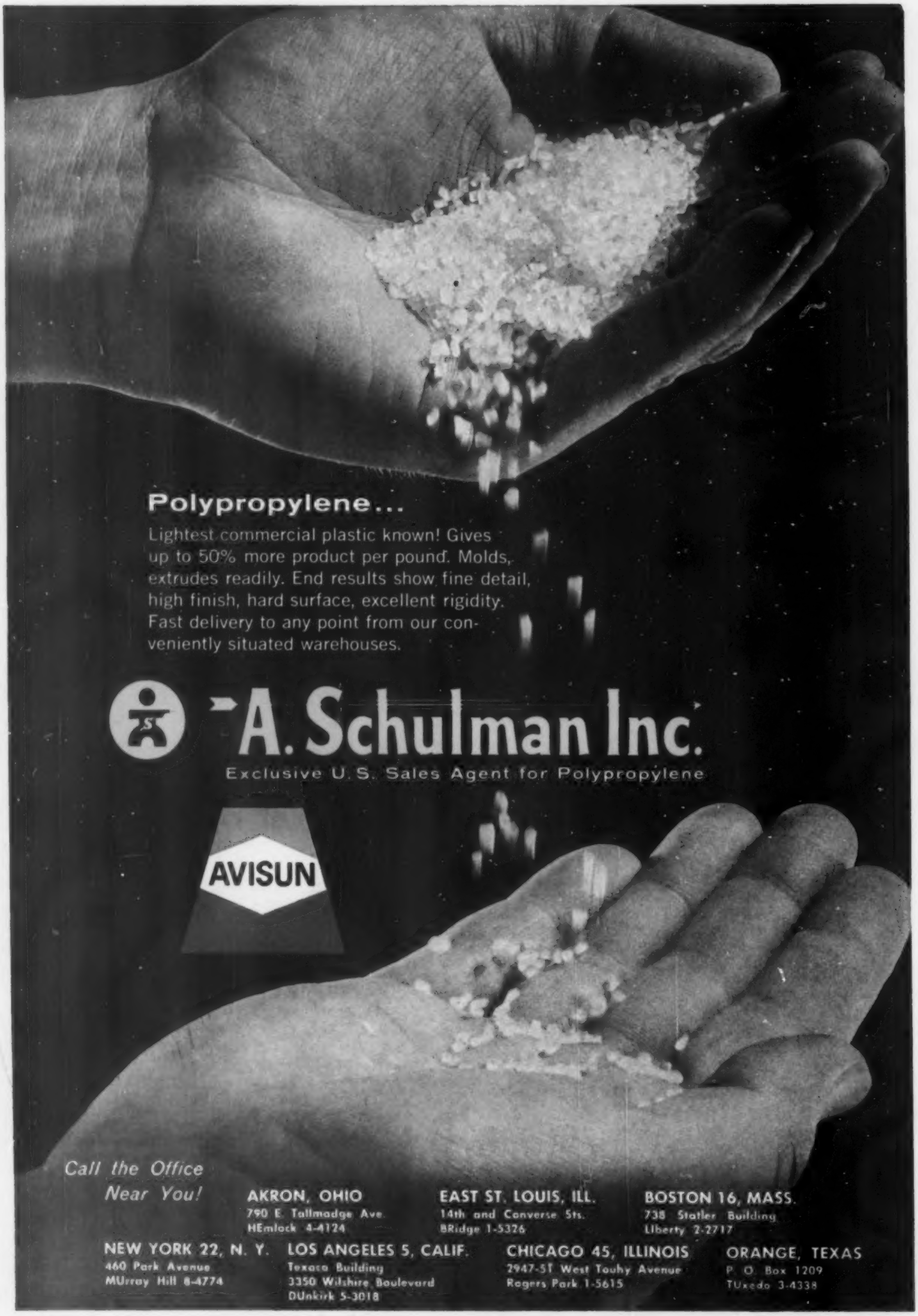
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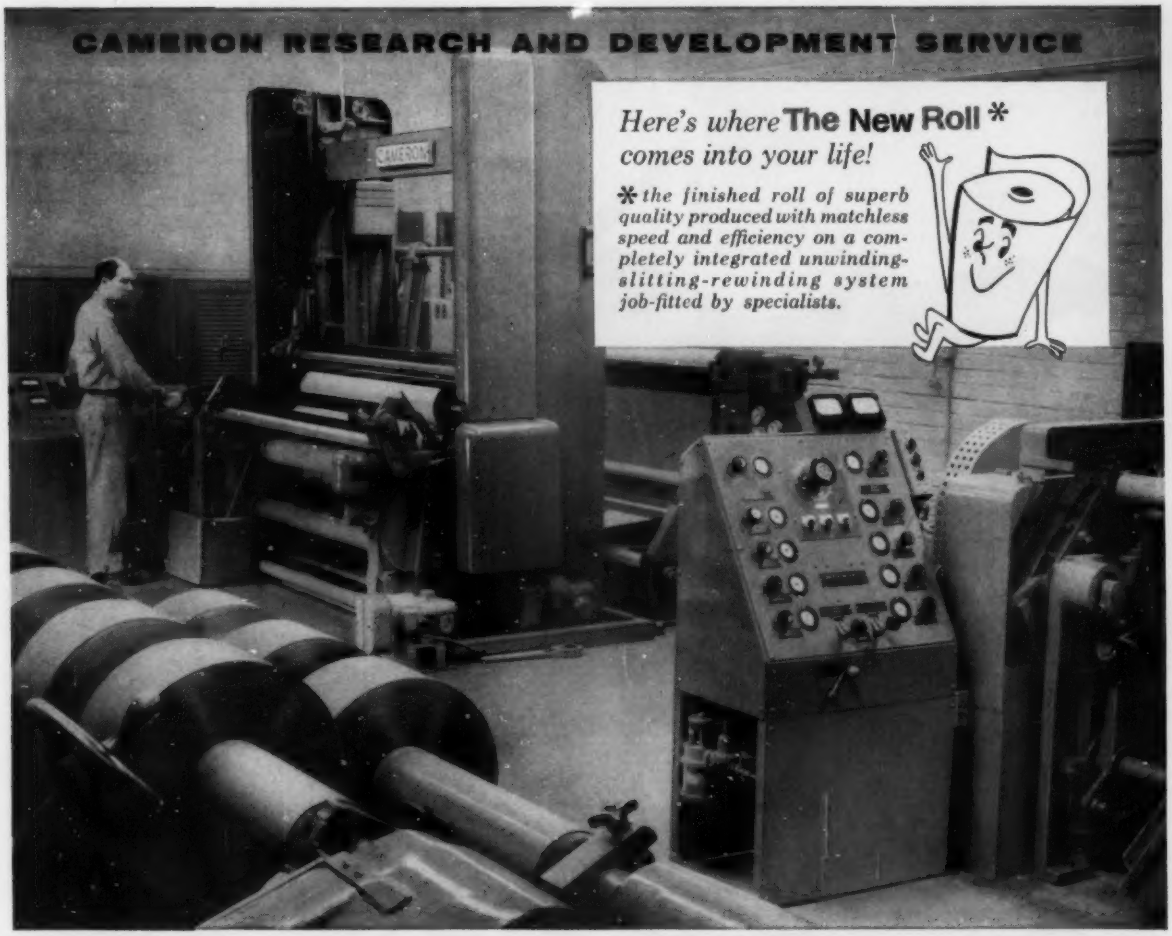

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Test-run your materials on a job-fitted "pilot" roll production system, perfectly integrated from unwind to rewind, engineered by specialists to meet your most exacting requirements—to give you The New Roll!

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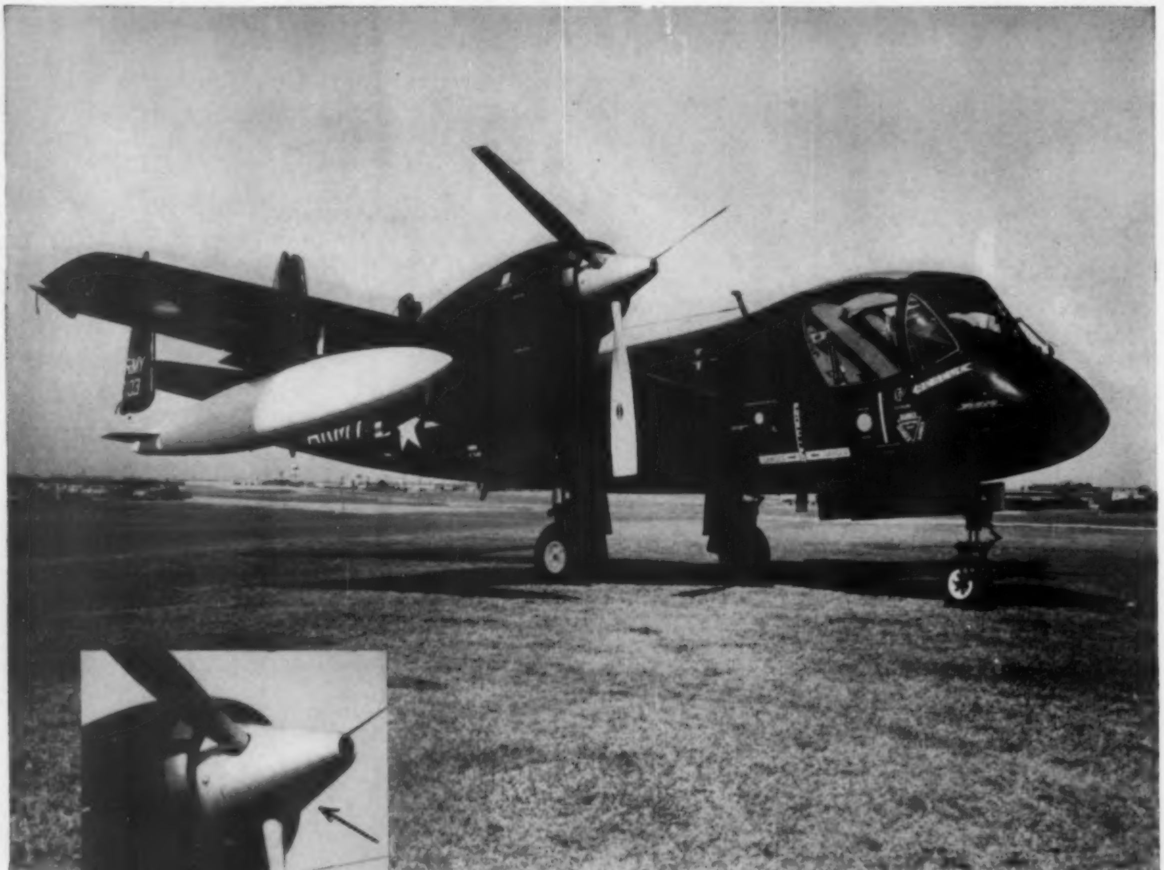

These epoxy-glass cloth "Spinners" (see close-up at left) were made by Fiber Mold Division of Hampden Brass Co., Springfield, Mass. Propeller assembly designed and manufactured by Hamilton Standard, Division of United Aircraft Corp., Windsor Locks, Conn.

"SPINNERS" OF EPOXY-GLASS CLOTH

dampen vibration, maintain strength despite alternate icing and heating

One of the outstanding features of epoxy resin glass-cloth propeller "spinners" now being used on Grumman "Mohawk" airplanes is their predicted long, reliable service life. The epoxy-glass cloth "spinners," which incorporate molded-in wire element de-icers for the aircraft's propellers, possess excellent tensile strength and fatigue resistance—very important properties for a part that is subjected to severe vibration.

In addition, the wire heating elements, that are laminated right in with the glass cloth and impregnated with BAKELITE Brand epoxy resin-based compound, have excellent electrical insulation. The strength-to-weight ratio of the "spinner" is high and production costs are substantially reduced.

Here is another example that shows how BAKELITE epoxy resins possess the versatility, and physical and electrical properties necessary to meet exacting product requirements. For further information on BAKELITE Brand epoxies write to Dept. FG-87, Union Carbide Plastics Company, Division of Union Carbide Corporation, 270 Park Avenue, New York 17, N. Y.

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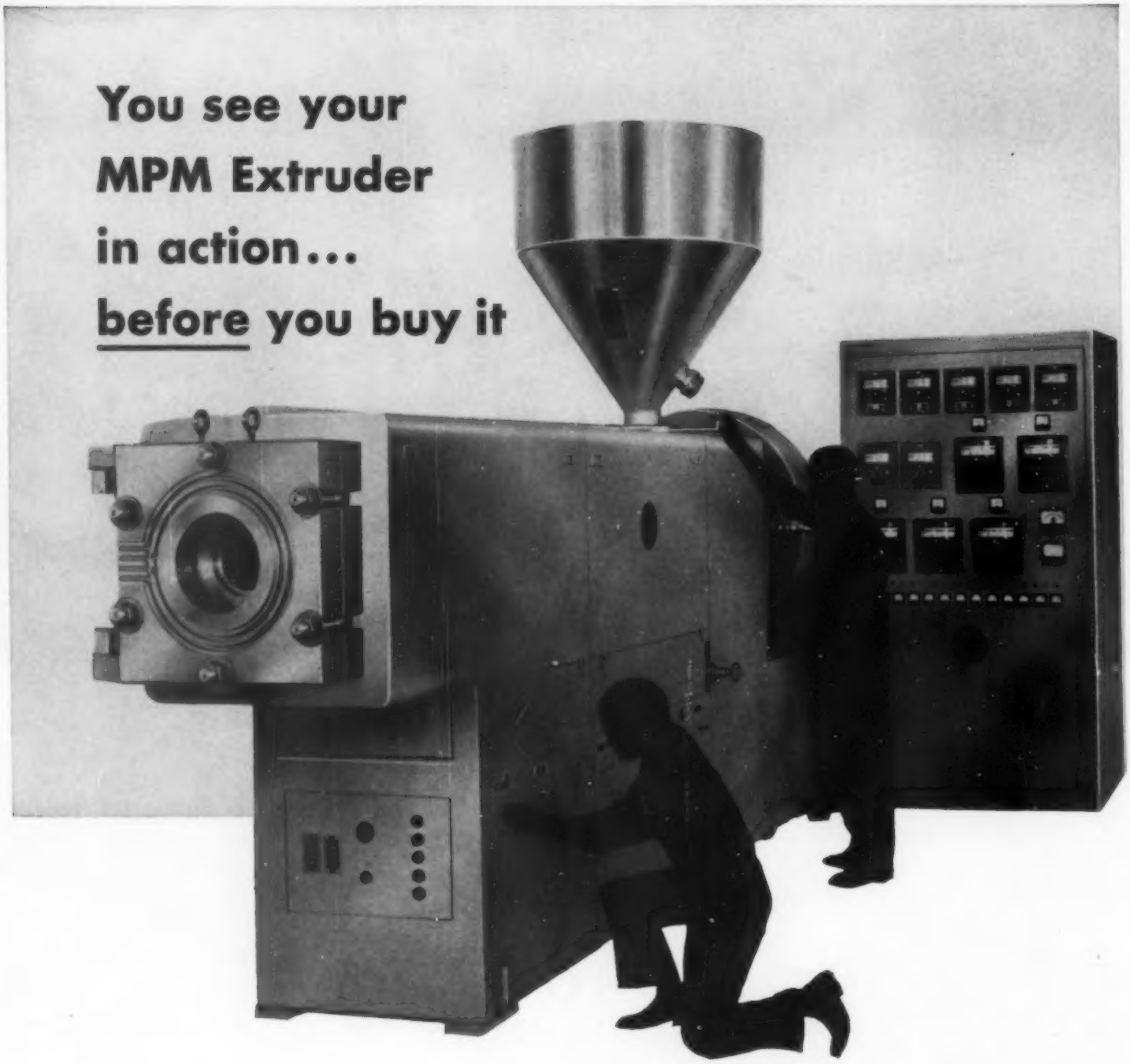
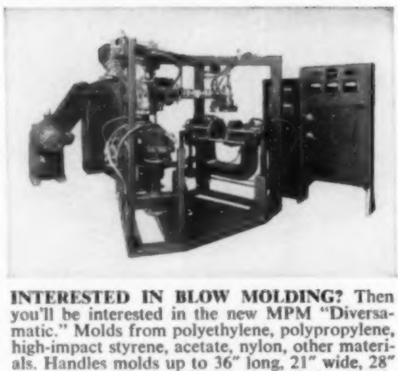


MPM doesn't sell merely extruders – it sells *production*. When you order an MPM extruder, you know exactly what caliber of performance you can expect, because you've seen it perform... had a chance to test every part before purchase.

Moreover, many extruders today are "patch-quilt" affairs: one piece made by this company, a second part by that, a third by still another. Not with MPM. For MPM manufactures virtually all its own components: grinds its own screws, assembles its own controls . . . all precision-built to MPM standards in MPM's modern, 90,000 sq. ft. plant.

Screw diameters available range from 1 to 12", in vented or non-vented design, and in L/D ratios of 20:1, 24:1 or longer Either resistance-band heaters, cast-in heaters or induction heating can be specified. Extra heavy-duty thrust bearings, Xaloy-lined barrels, and precision-ground screws are typical of rugged MPM components. In short, MPM extruders are tailored for your specific needs, then proved out to you before you buy. More information? Just write Modern Plastic Machinery Corporation, 64 Lakeview Avenue, Clifton, N. J.



INTERESTED IN BLOW MOLDING? Then you'll be interested in the new MPM "Diversamatic." Molds from polyethylene, polypropylene, high-impact styrene, acetate, nylon, other materials. Handles molds up to 36" long, 21" wide, 28" daylight. 14" stroke. Automatic built-in electric counters. All-pneumatic system. Works with any extruder, either U.S. or foreign-built.

Modern Plastic Machinery Corporation

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MARLEX* approved by all major detergent suppliers

The inherent advantages of lightweight, attractive, and unbreakable plastic containers are unquestioned—more sales appeal, less costly to ship, no breakage, to name a few. Equally unquestioned are the reasons why MARLEX high density blow-molding resins are widely approved for modern detergent containers.

MARLEX blow-molding grades cost no more! Yet, they provide high stress cracking resistance, great rigidity and strength per mil of wall thickness . . . as well as easy processing at high production rates—in short, superb and economical plastic containers.

Today, countless marketers of liquids—starches, bleaches, waxes, shampoos, cough syrups, and the like—are switching to containers made of MARLEX. Our engineers have pioneered the use of high density polyethylene and ethylene copolymers for blow-molded containers. The accumulated knowledge and experience of their work is available to those interested.

**MARLEX is a trademark for Phillips family of olefin polymers.*

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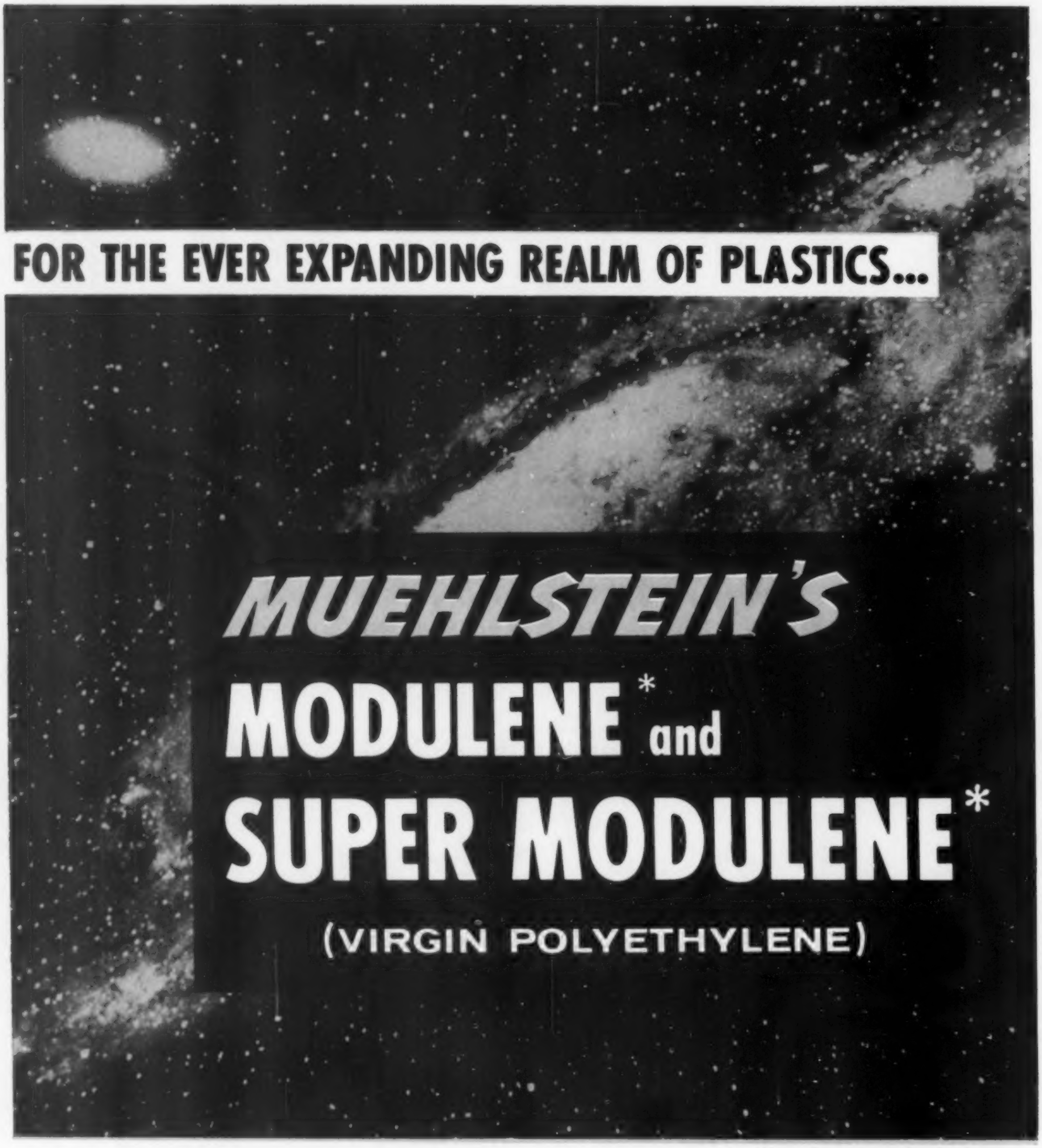
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MUEHLSTEIN'S
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Stimsonite Division
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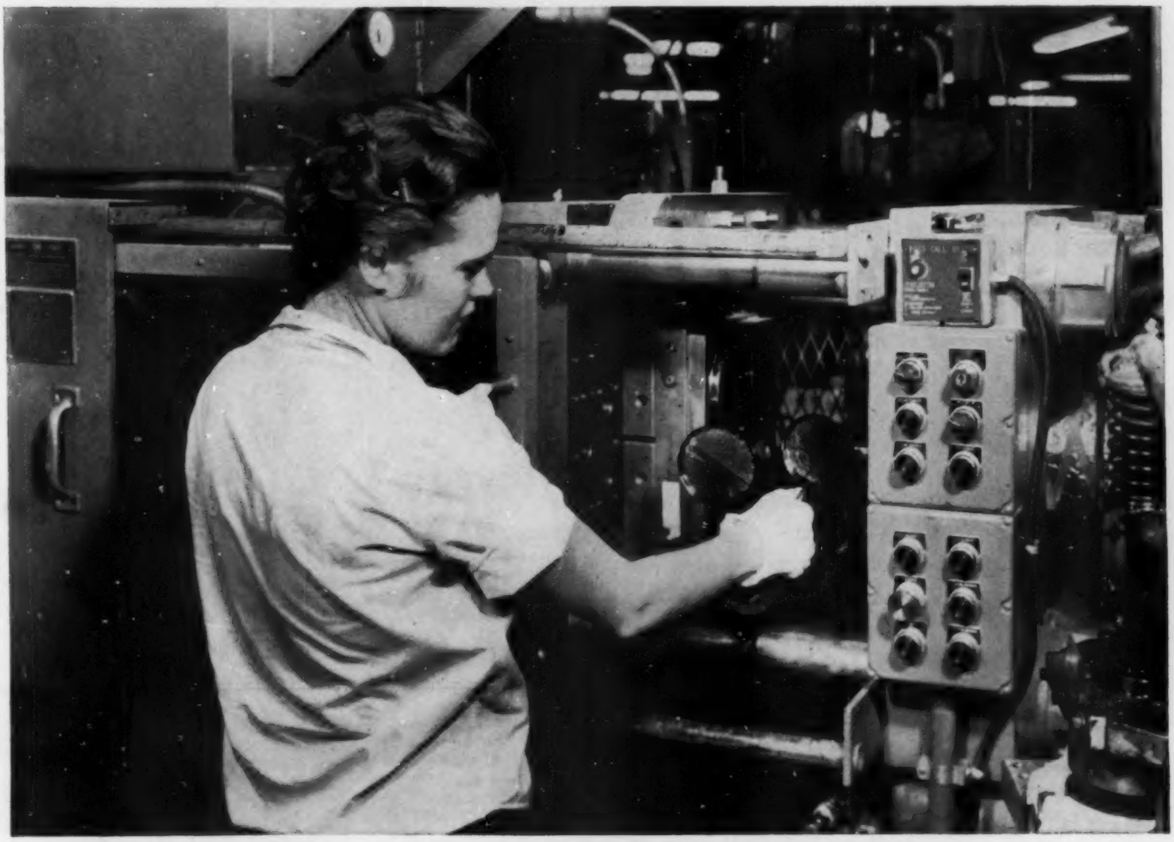

Progress in Plastics by
A MOLDER ON THE MOVE

H-P-M PRECISION SHOT CONTROL ASSURES QUALITY

Accuracy is reflected in every job this company does. Using patented pin-pack tooling, designed and developed by Stimsonite, tiny reflective surfaces are molded into each lens. Exacting shot control, injection pressures and temperature are necessary for this accuracy in molding every Stimsonite product. Without this control — *without H-P-M control* — the best molds can sometimes misbehave. You, too, can benefit from the built-in accuracies in every H-P-M.

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HPM

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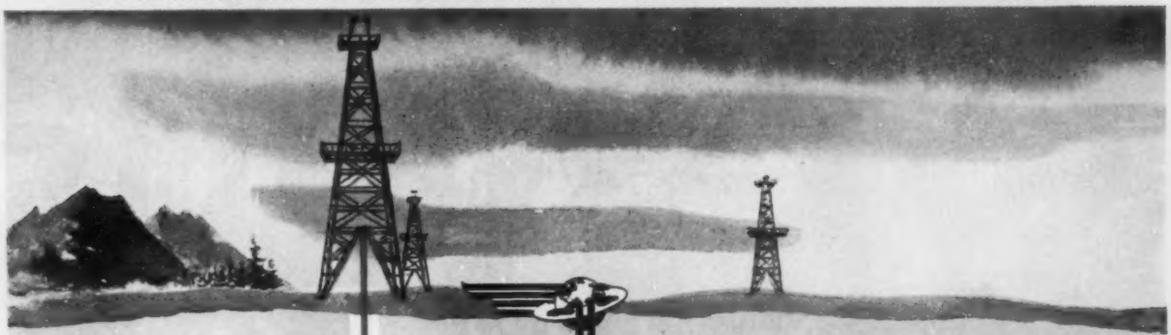
IF PHENOLICS CAN DO IT **PLENCO** CAN PROVIDE IT—AND DOES—FOR **HALLIBURTON**



HALLIBURTON 5W PLUGS have a down-to-earth job to do for oil well drillers... and do it with the help of

PLENCO

PHENOLIC MOLDING COMPOUNDS

If you're going to bring in a gusher, it would be a good idea to have someone like Halliburton standing by.

Cementing the critical areas around the steel casing may be called for—for helping to protect against many down-hole hazards such as salt water flow, sulphur water, electrolysis, freshwater strata, high pressure gas, etc. And Halliburton Company, Duncan, Oklahoma, are specialists at that, leaders in service to the petroleum industry for over 35 years.

Ordinarily in most areas when cementing a well, the Halliburton 2-plug method is essential. Halliburton's type 5W bottom plug wipes the pipe clean and keeps the drilling fluid separated from the cement. The 5W top plug reduces channeling of displacement fluid through the cement. Heavy-duty cementing plugs are made of flexible molded rubber, with a 5-wiper design. The hard inner core of each plug is molded of a Plenco phenolic compound (Plenco 386).

This compound is formulated for use on parts having very thick sections. It was selected by Halliburton for this as well as for its ability to be bonded so securely to the rubber exterior that it is virtually impossible to separate the two.

Unlike Halliburton, *your* product may belong in the air rather than underground. Or it may be used on the farm, in the kitchen, on the highway. Wherever it goes, there's likely to be a Plenco general-purpose or special purpose phenolic molding compound that can make it go better, work better, look and sell better.

A conversation with our technical staff can help you "strike oil." Call on us at any time.

PLENCO PHENOLICS
FOR BETTER PLASTIC PRODUCTS

PLASTICS ENGINEERING COMPANY

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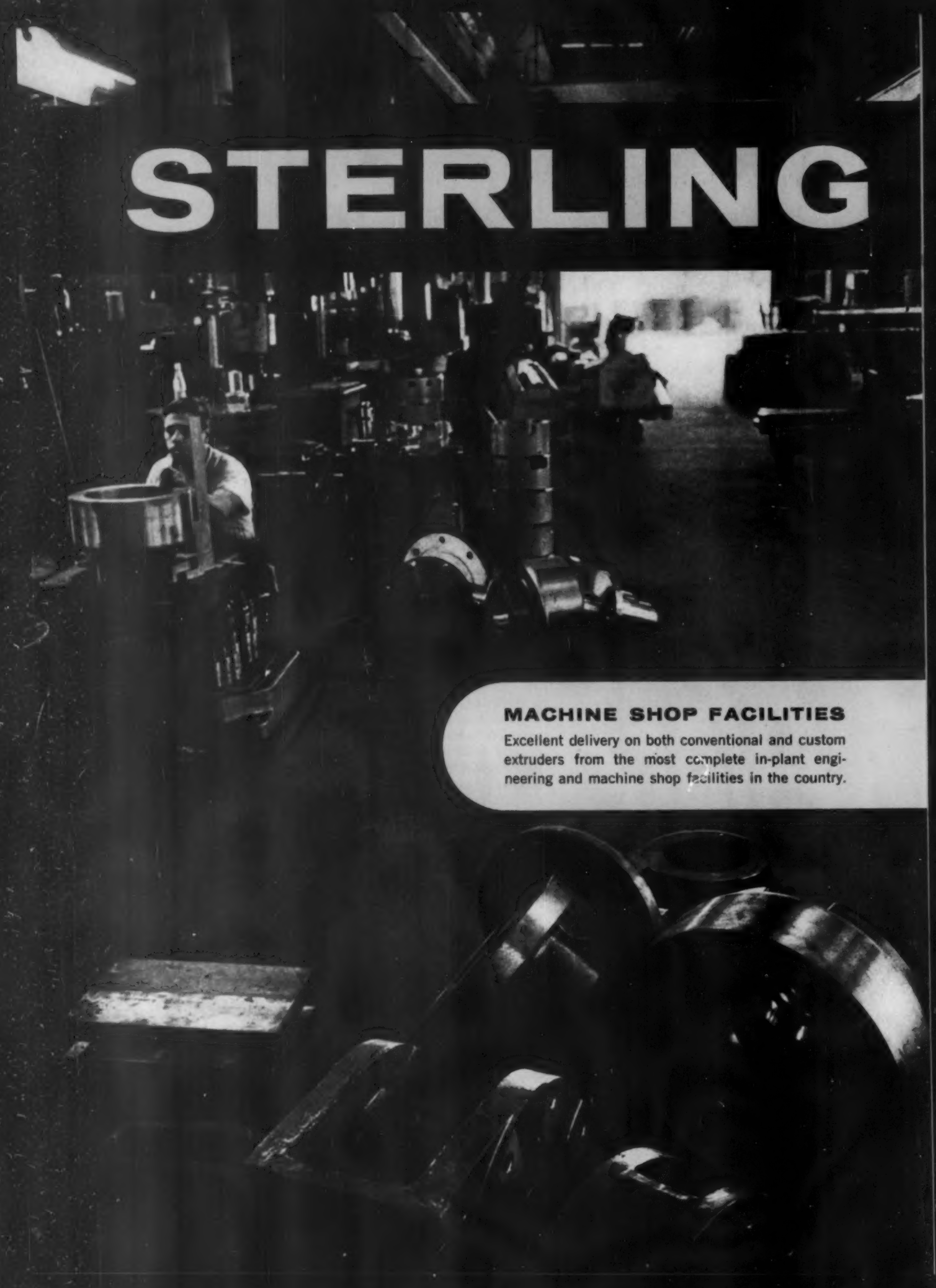
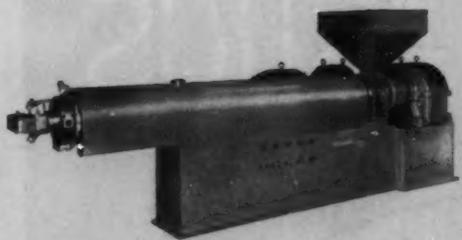
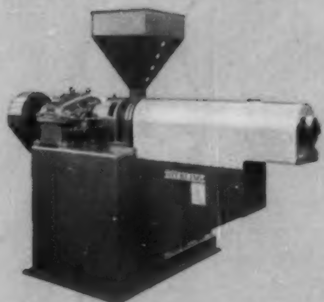
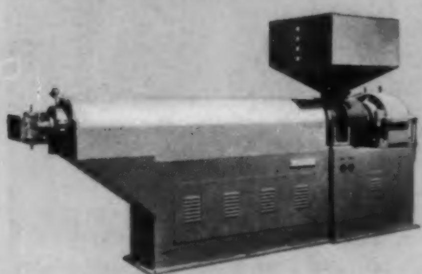
SERVING THE PLASTICS INDUSTRY IN THE MANUFACTURE OF HIGH GRADE PHENOLIC MOLDING COMPOUNDS, INDUSTRIAL RESINS AND COATING RESINS


STERLING
MACHINE SHOP FACILITIES
Excellent delivery on both conventional and custom extruders from the most complete in-plant engineering and machine shop facilities in the country.







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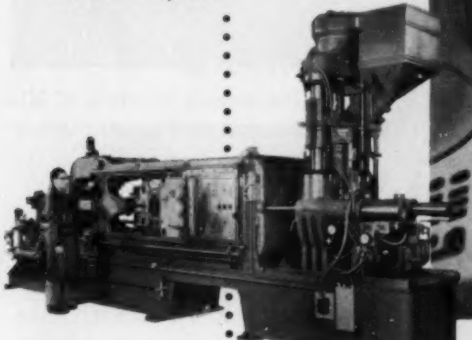
"These Quality Parts run best on our new 24/32 ounce LESTER...

NO WELDS...
NO FLASH...
...just perfect finish!"

So says Mr. L. A. Lynch (right), superintendent at Auburn Plastics, Inc., in Auburn, N.Y.



"For example, we had been running this Remington adding machine cover on another machine, with considerable trouble over a weld mark on the front wall of the part. We worked hard to correct this, modifying the mold, trying various materials, and finally raising mold and material temperatures and lengthening the cycle."

Mr. E. F. Baran (left), general foreman, continues. "Then we put it on the new 24/32 ounce Lester. It took off! Lower temperatures, no weld or flash, and just the right finish to please our customer... not to mention a distinct improvement in the cycle. We really don't know the maximum plasticizing capacity of this new Lester...we haven't hit bottom yet. And we're particularly pleased with its sensible range of controls in cycling speed, mold stroke adjustment and heat control."

L LESTER ENGINEERING CO. CLEVELAND, OHIO 25th

Complete 4-page spec sheets on the new long-stroke L-450-24/32 ounce Lester are available on request.

LESTER-PHOENIX, INC.

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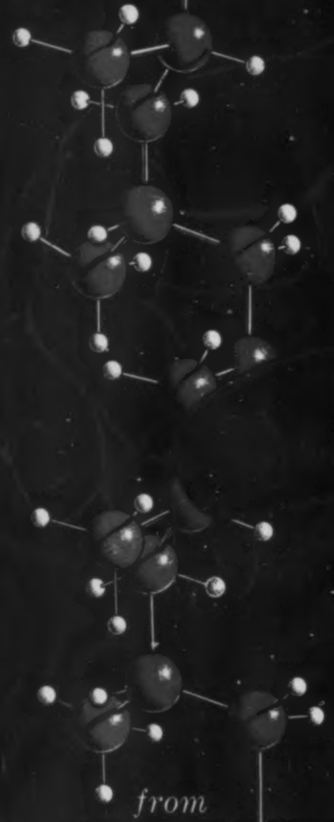

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milestone in the conquest of inner space

Everywhere chemists are exploring the way molecules are put together... putting atoms together in exact, predetermined relationships with each other ... producing spatially-ordered molecules ... making useful products from these polymeric materials with designed-in properties for specific applications.

Leader in this conquest of inner space is Montecatini, who developed the first stereospecific polymer, MOPLEN® polypropylene. The forerunner of a revolutionary class of plastic materials discovered by Giulio Natta of the Polytechnic Institute of Milan, MOPLEN® is being widely used in Europe and in the United States.

Montecatini continues to explore this new world of structural chemistry ... is developing new polymerization catalysts and producing new polymers with exciting potential as plastics, textile fibers and elastomers in the products of tomorrow.

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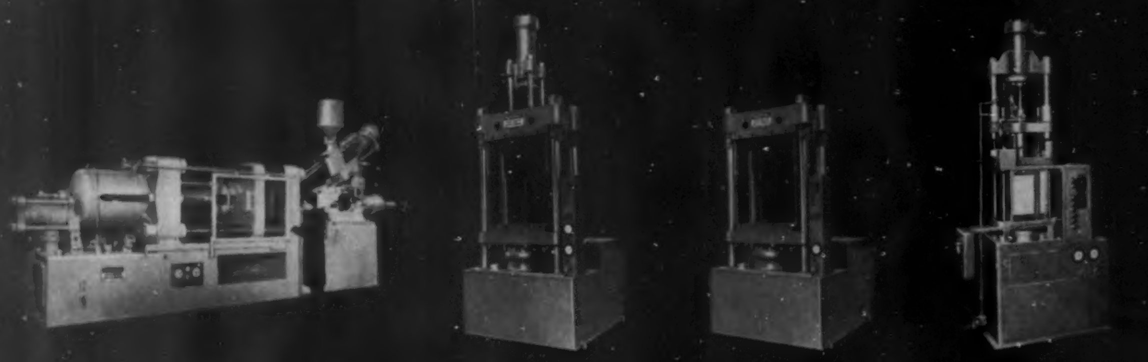

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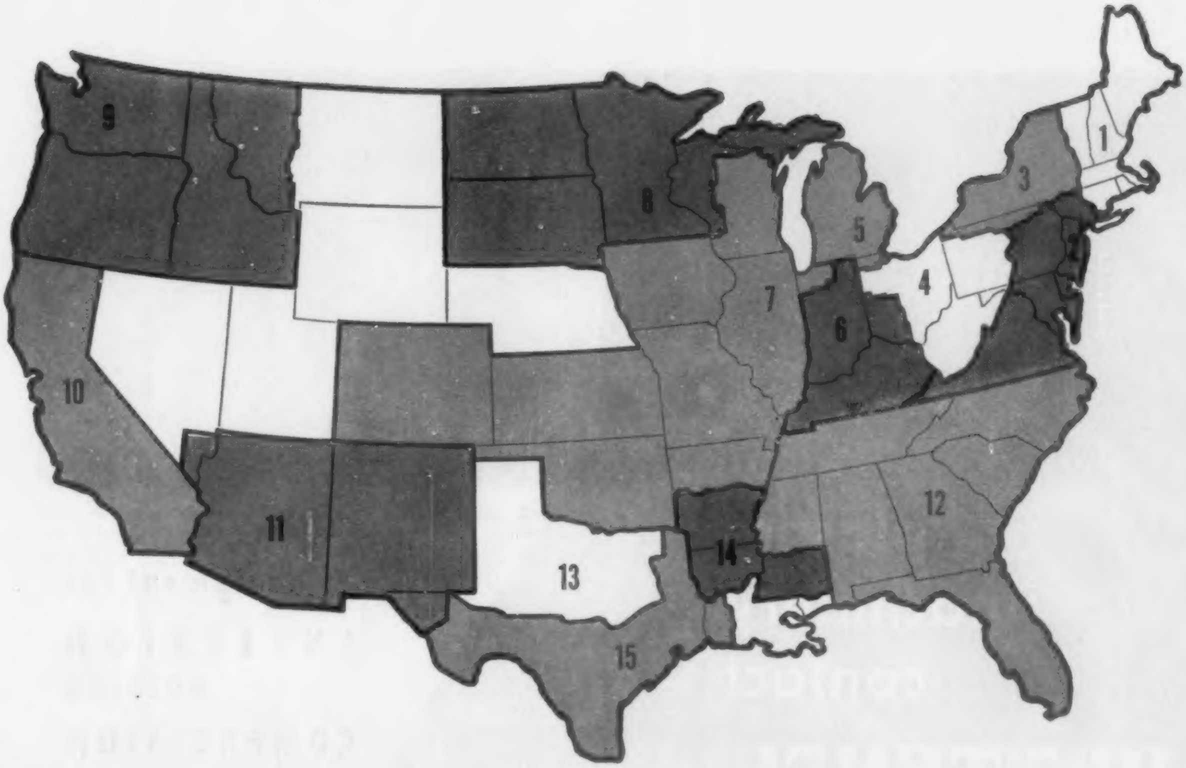

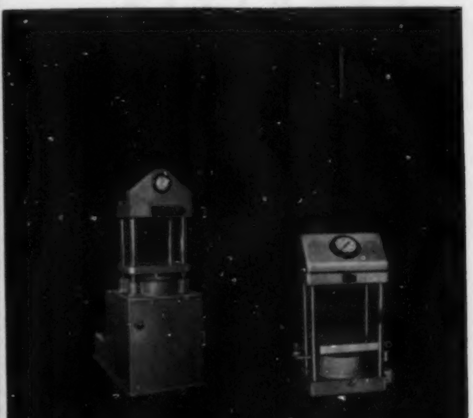

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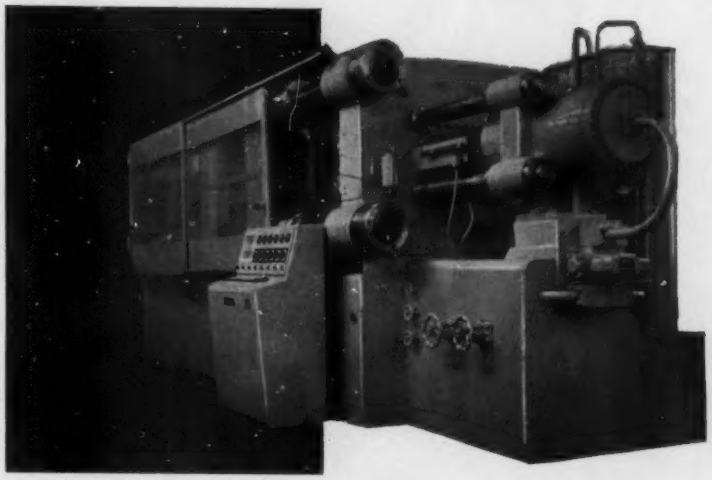

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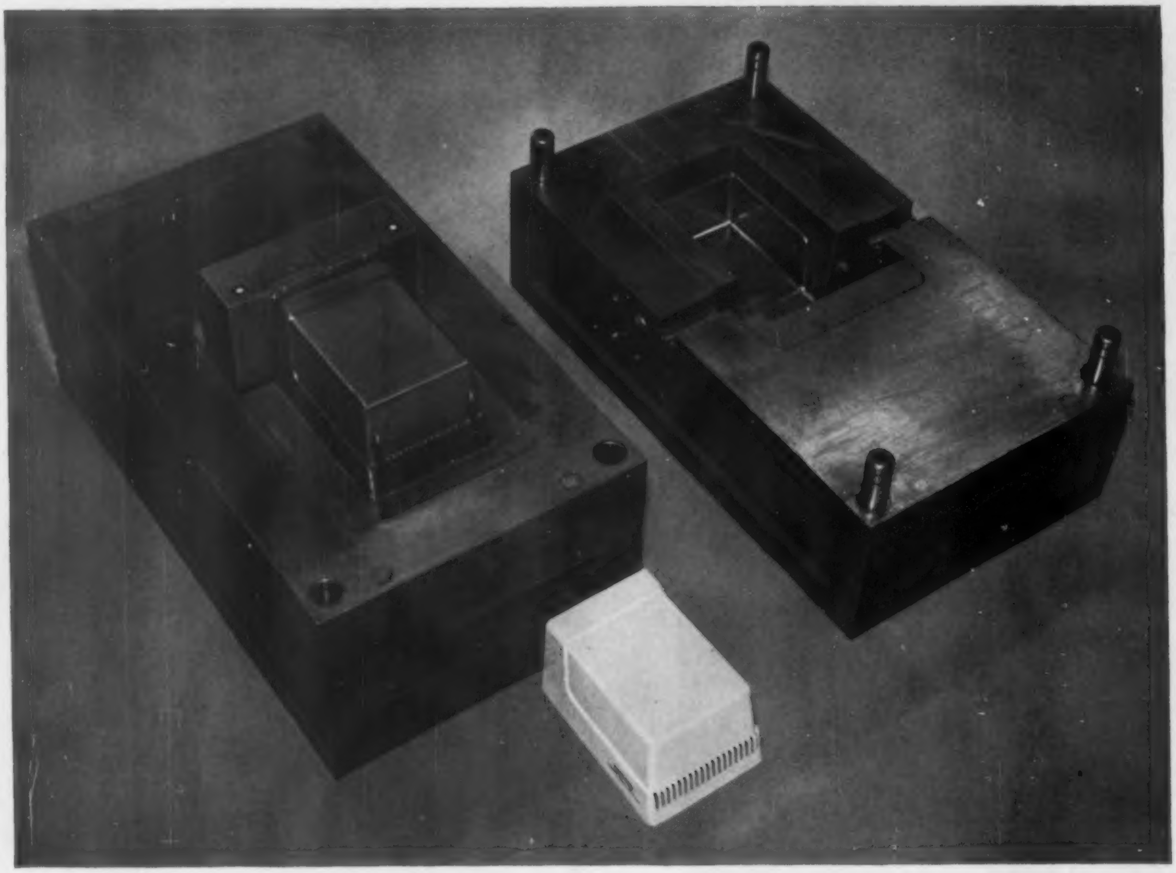

Lustre-Die does smooth job in molding can-opener housing

Bethlehem Lustre-Die tool steel, which is furnished pre-heat-treated in bars, recently scored a big hit in molding this can-opener housing, of high-impact polystyrene.

Lustre-Die saved time in the shop because it did not require heat-treatment. It was easier to machine than other pre-hardened grades which were used previously. Moreover, it polished beautifully, and imparted a high sheen to the finished part.

Lustre-Die, an electric-furnace steel with a well-balanced analysis, can be polished to a high gloss, making it ideal for producing plastic parts which require a high lustre. The grade also has a special alloy fortification which further increases its depth of hardenability, and enhances its mechanical properties. It is heat-treated by oil-quenching and tempering, and is furnished ready for machining and polishing.

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THE PLASTISCOPE*

News and interpretations of the news — By R. L. Van Boskirk

Section 1 — **November 1960**

Styrene expansion at Monsanto. A "new family" of styrene-based materials is to be produced by Monsanto as part of an expansion at its Addyston, Ohio plant. Heat-resistant and high-impact polystyrene will also be produced in the new plant. The new installation, scheduled to be in operation in the last half of 1961, will increase the company's domestic production of styrene-type molding and extrusion materials by 25 percent. The expansion will make the Addyston site the company's second major installation to manufacture styrene-based plastics. Other plants are at Springfield, Mass., and Long Beach, Calif.

Styrene monomer for the new operation will be transported by barge from the company's monomer plant at Texas City, Texas.

An interim plant at Springfield will begin producing the new materials before the end of this year. Guesses in the trade are that the new materials will be ABS (acrylonitrile-butadiene-styrene) and SAN (styrene-acrylonitrile) copolymers. Sales of these two today are thought to be in the 50- to 60-million-lb. range, but no one can prove it. ABS has had a lot of recent publicity—partly from its application for telephones and the possibility that it may move into the refrigeration field. But SAN may yet be the more important of the two on a poundage basis—its transparency and chemical resistance offer many possibilities.

The main stumbling block to large volume use of both is price. When a good application has been developed, impact styrene has frequently moved in at lower cost. Both ABS and SAN sell for around 40 cents. But there is always a possibility that large volume use will help lower the cost, especially since styrene and acrylonitrile monomers have been on a price decline for some time and may go lower.

More polystyrene film. Another biaxially oriented polystyrene film, called Visolyte, is now available from Plastic Films Div., Visking Co., a subsidiary of Union Carbide Corp., Chicago, Ill. Because of its optical properties and economical price, it is expected to gain wide acceptance for packaging and overwrapping. Uses are window envelopes and display cartons, overwrap for tubed tomatoes, and as a laminate to high-impact polystyrene for decorative uses. It offers good machinability and printability, is easy to remove when used as an overwrap, presents no blocking problem, and is said to offer good low temperature performance. It is also claimed to be "breathable," which makes it good for produce packaging. The film is available in thicknesses from ½ to 2 mils and in widths up to 46 inches.

Santofome now available. Monsanto's polystyrene foam film is now available in commercial quantities in rolls of varying widths. Santofome is described as "wrapping air in polystyrene." It is a material with a satiny surface that is expected to compete with paper in many fields. Present thicknesses range from

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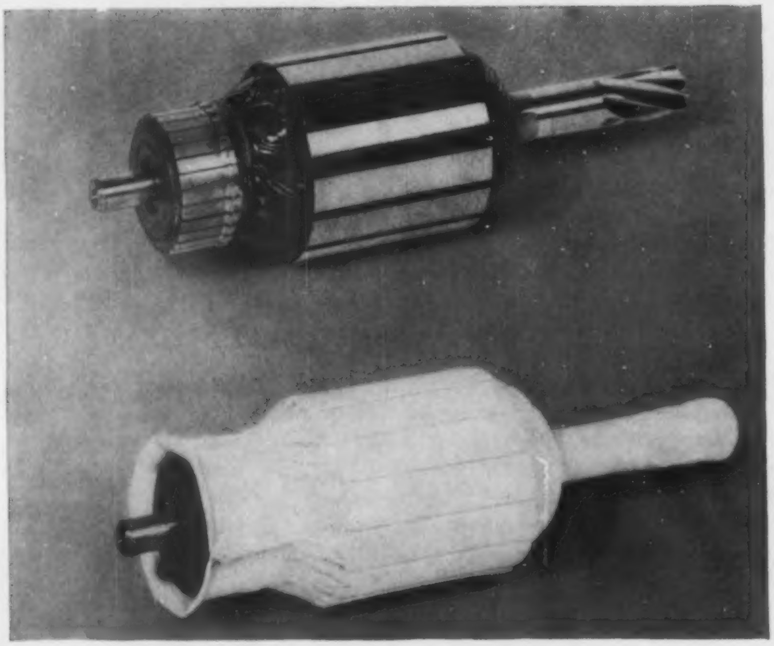
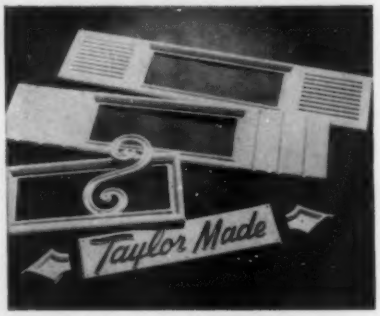


Garage doors decorated with Campco Butyrate

As a rule, a garage door is a rather dull and uninteresting piece of architecture. But Taylor Garage Doors, Inc., of Detroit have done something about it. Now their single and double garage doors can be decorated with numerous combinations of attractive trim in the form of shutters, windows, escutcheons, etc. Sold in kits for "do-it-yourself" application, the homeowner is provided



with the means of relief from the bare, flat planes of typical garage doors. They can be painted to match or complement the color of the door, require less repainting, and will not rot or corrode.

They are vacuum-formed by Taylor from Campco B-120 white opaque Butyrate, selected for its uniform thickness and consistent quality of whiteness.

Taylor finds that vacuum forming of Campco sheet affords an economical means of varying the designs without incurring the expense of carvings or metal stampings and finishing operations.

This new method of insulating electrical components utilizes thermoplastic sheet

It hasn't been called "Skinsulation" yet but it well might. It's a new method of insulating electrical components by the use of epoxy resins and a skin of thermoplastic sheet. The idea was introduced by Minnesota Mining and Manufacturing Company and its advantages are so obvious that it is bound to find a great many applications. It has been demonstrated on various types of components using "Scotch-cast" Brand Resin and Campco thermoplastic sheet.

The above photograph shows how Campco thermoplastic sheet was vacuum-formed around the component. This becomes the mold form, eliminating the steel mold. An opening is made at the top through which lead wires may be brought out. Cardboard or tape is used to hold the wires in position.

Through this same opening, the resin is poured in until the mold form is completely full. The resin reaches the most remote area insuring complete coverage. The part is then ready for curing.

Simple, isn't it? It's efficient, too, for any number of articles of varying shapes and sizes can be skin-wrapped simultaneously. The size of the vacuum-forming machine is the only limiting factor, while with the present method production is limited to the number of molds that can be used on a production cycle.

Dollarwise, there are worthwhile savings in labor and material. Where steel molds are now being used, increased production can easily be realized by making a number of vacuum molds from the master molds.

And here's another important advantage. Since by the new system production is not limited by the number of molds, presently used curing cycles may be completely changed. For example, in order to obtain three or four cycles per eight hour shift by the old method, resins must cure at 150° F. While, by the new system, a whole day's production can be cured overnight at a slower rate with the use of room curing or slower heat resins.

If you would like technical assistance or further information regarding this system, write Campco Division of Chicago Molded Products Corporation.

Received Your Campco Personal File? This data-packed reference file on thermo-plastic sheet and film is yours on request—just send name and address on Company letterhead to Campco, 2717H Normandy Ave., Chicago 35, Illinois.

CAMPCO Sheet and Film, **a Division of Chicago Molded Products Corp.**

THE PLASTISCOPE

(Continued from page 39)

10 to 30 mils. In comparing it with paper prices, one user says that \$11.80 worth of Santofome compares with \$12.00 worth of paper—and this on 10 vs. 2 mil basis. Another user says that, on a yield basis, a \$100 order for paper would cost \$96 in Santofome.

The film has fine insulating value and, it is believed, will have wide use for formed cups where it will cost no more than paper. The polystyrene cups can be formed on conventional paper cup forming machines and can be used in vending machines.

Santofome can be printed without trouble on a rotogravure press; a letter press would need alterations to handle it because of light weight, static, and feeding problems. It can be easily embossed, and vacuum drawn, and can be used like paper on standard wrapping machines.

As a decorative paper or a cushioning material, it is unlikely to abrade or scratch highly polished surfaces. As a multiple layer laminate, it makes a low-cost stadium seat for athletic contests. It is suggested as a decorative surface laminate, a liner for corrugated boxes, paper plates, candy box liners, produce and meat trays, doilies, table mats for picnics, frozen food overwraps, and even laminated automobile head liners.

Hercules announces six types of polypropylene. Availability of six different melt flow ranges of Pro-fax polypropylene have been announced by Hercules Powder Co. This is the broadest range yet announced by any producer. Field data indicate that the best melt flow index for isotactic polypropylene for general use is in the 2.2 to 4.8 range, using procedures of the 12 230 ASTM Test except that a temperature of 230° C. is used instead of 190° C. (but load is the same—2160 grams). This melt flow range provides a combination of strength, toughness, and flow properties, using stock temperatures in the range of 500° F. for rapid-cycle molding and extrusion. Flow ranges above or below those mentioned are available on a commercial scale if desired.

The six different types now produced are: general purpose injection molding, general purpose extrusion, high melt flow grade, film grade, low melt flow grade, and extra-low melt flow grade.

Polypropylene in use. AviSun reports that three bakeries in the East are now using its polypropylene film for bread wrappers. This is not claimed to be for each bakery's total market, but it is enough to be a substantial part of the whole. AviSun asserts that 1 mil polypropylene film at 70¢ a lb. or 0.0225¢ for 1000 sq. in. is less costly than MS 300 or 400 cellophane at 62¢ with a cost of around 3¢ for 1000 sq. in. because of the yield. As compared to polyethylene film, the polypropylene is said to give the same strength at 1¼ mil that PE does at 1 mil.

Another use reported for polypropylene film is that of a Chicago concern that is using it for wrapping typing paper, adding machine tape, and specialty papers. The products are wrapped on a standard Hayssen machine on which the roller is coated with Teflon and sharper cutting knives have been installed since the PP is so tough. The film is used because of long shelf life, gloss, clarity and feel.

Still other uses are for overwrapping paper plates, a 2-mil bag

THE PLASTISCOPE

(*Continued from page 41*)

for a macaroni product, lamp shades, and a 1-mil film in a drum liner for asphalt. A highly interesting application for polypropylene molding powder that was reported by AviSun is a $19.95 radio cabinet that is just getting under way.

New phenolic for laminating varnish. Attention should be called to a new phenolic laminating varnish recently introduced by Monsanto Chemical Co. under the name Resinox 495. It is asserted that never before has there been such a resin with *flame retardant* properties that is suitable for cold punching and also has good electricals. It is also stated that the new resin has less moisture absorption than most others. Price of the varnish is 29¢/lb. Because of its flame retardance and cold punch properties, it is particularly suggested for printed circuits in computers.

Phenolic prices up. The recent rise in the price of phenolic compounds underlines the fact that this section of the plastics industry has had one of the most stable price structures over a long period of years that any industry can brag about. For example, a typical phenolic general-purpose compound sold for 17¢/lb. in drums in 1932. Since that time it has fluctuated in the narrow range of 13.50¢ in drum lots to 21.20¢ in carload lots. There were no carload lots in 1930. Today the new price of this particular compound is 20.70¢, up 1.5¢ from the previous price which was set about two years ago. In the meantime, automobiles, for example, have increased prices by threefold.

There are various levels in the new price pattern, but the schedule tends to equalize them more than previously. Practically all g. p. molding materials went up 1.5¢ which makes them 21¢, except one-step closure material which went up only 0.5¢ and is now the same as general purpose. Washing machine agitator formulations are an exception—went up only 0.5¢, presumably because of pressure from other materials.

Industrial phenolic resins also went up in various amounts. Liquid resins for laminating, battery separators etc., went up 0.5¢/lb. on a liquid basis—from the lowest at 18¢ to the cresols that vary from 22 to 25¢. Solid (pulverized) resins went up generally by 1.5 cents. Foundry resins went up 1¢ but had already gone up a month before and are now mostly around 27.5 cents. The solid resins are used primarily for underpadding rugs, brake linings, grinding wheels, coated abrasives, and in thermal insulation.

Vinyl chloride polymer production capacity. Bankers, brokers, and market analysts may have been astounded to see the 2.4-billion-lb. capacity figure for vinyl chloride in this column last month; but vinyl producers were quick to recognize it as a slip of the pencil, although some wryly stated "it might as well be." The capacity figure should have been printed as 1.4 billion, with a consumption figure of about 900 million in 1959 and an estimate of about the same in 1960. It is obvious from these figures why vinyl chloride polymer prices have been declining. Capacity is just too far ahead of consumption. The same situation prevails in monomer production, only more so; and a slight price break did develop last month. (To page 45)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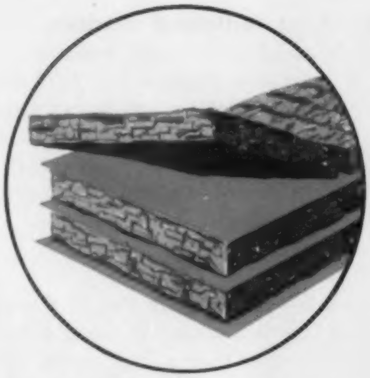



STRIP-EASE
Riegel

THE PLASTISCOPE

(*Continued from page 43*)

Sheet for packaging. Rigid vinyl sheet for food packaging which will meet non-toxicity requirements of both FDA and the Meat Inspection Div. of the U. S. Dept. of Agriculture, according to the producer, is now available from Seiberling Rubber Co. The sheet was developed for this particular purpose after Congress enacted the recent and much discussed food additives amendment.

The calendered, unplasticized sheet is furnished in thicknesses of from 7½ to 15 mils of opaque to frosty clear material. The new formulations will take processed foods at around 175° F. and thus permit packaging at high temperatures so that preservatives will not have to be added. It can be vacuum formed into contour packages when desired.

This type of sheet has been particularly useful in the packaging of small portions of food, such as jelly and similar foods, for "one-shot" customer use in restaurants. Now it will meet use-standards even for catsup. Seiberling is of the opinion that in the future it will become valuable for meat packaging, since it has received the Meat Inspection Division's approval.

An error to end errors. A common error occurred in this column last month in describing a Bakelite polyethylene coating resin as a "high-pressure linear" resin. Such a material is not possible to make as yet. Linear resins are made by the low-pressure process only.

But this error emphasizes the problem of polyethylene nomenclature. Most people identify them generally as high- or low-density and, strangely enough, the high-pressure method is used to make low- and medium-density resins, 0.915 to 0.939 or thereabouts, and the low-pressure method is used to make resins of higher density. Nor is melt index sufficient for a good operational definition of a polyethylene resin. And even if the two are combined, we still don't have the answer. To add the factors of polymerization technique and blends would make the nomenclature extremely unwieldy; which may be why *density* has been generally chosen as the easiest way out. But the problem is that density is no longer of much use in indicating resin properties.

For example, there is the 0.940-density problem. A resin of this density can be made by polymerizing through either the low- or high-pressure process, by copolymerizing, or by blending high- and low-pressure resins. Then there is the special pipe compound which is listed as 0.941-density which contains a 0.927-density resin but the added carbon black brings it up to 0.941 or so. The significant factor is that every single one of these resins has different properties, so density is a useless bit of terminology in this case. There are already various examples in other densities that are combinations of high- and low-pressure material and more will follow. Whether a resin is polymerized by high- or low-pressure is frequently a fact that need be known in order to obtain a clue to a material's properties, but "density" is becoming a more and more dangerous designation. One authority suggests that just the word "polyethylene" be used, without modification, except perhaps for industry-wide symbols that would indicate high- or low-pressure, density, melt index, and other necessary information. In any case, it's a troublesome problem where a good imaginative mind is needed to unsnarl the tangle that is becoming more tangled every day.

For additional and more detailed news see Section 2, starting on p. 238

LETTERS TO MODERN PLASTICS

Where readers may voice their opinions on any phase of the plastics industries. The editors take no responsibility for opinions expressed.

Plastics and drugs

Sir: You are to be congratulated on one of your recent editorials concerning standards for RP boats. As we are all aware, there is a wide acceptance by the public that any type of reinforced plastic boat is safe to use under any condition. It is also unfortunate that many "shoddy" manufacturers are taking advantage of the reputation of conscientious boat builders whose primary concern is the safety of the occupants of the boat. Protection of the public demands that some form of testing be initiated to insure that plastic craft are sea-worthy.

In another field, there is also a very serious problem developing which may have ominous implications in the future as far as safety is concerned. I am referring to the expanding use of plastics for packaging materials and for devices for the administration of drugs, such as syringes and tubings. The same thought which appears to be prevalent with plastic reinforced boats is also lurking in regard to plastics and drug products.

Fortunately, this problem does not exist when a recognized, ethical pharmaceutical firm manufactures and packages its own medicinal product in a plastic container. Rigid testing procedures by the control department eliminates those plastic materials which are incompatible with the drug product. Many smaller firms, however, not being completely aware of the potential plastic-drug interaction, might overlook this possibility. Furthermore, many small pharmaceutical firms are not adequately equipped nor do they have the technical personnel to conduct rigorous testing procedures and, hence, must rely on their own appraisal based upon bits of information from here and there. This certainly is not an ideal situation and may be quite misleading if the information has not been substantiated with proper testing.

The real threat to safety, as I see it, falls in those instances where a plastic packaging material or device is to be used by hospital pharmacists, clinicians, and nurses for the storing or administering of a drug product. How often have I heard from one of the above that one need not worry about the device since it is completely safe because it is made from a plastic material. Part of this thinking comes from the promotion of these plastic articles to the hospital and its staff through direct advertisement or through contact with the sales personnel. Catchy words such as "medical grade," "hospital tested," and "surgical grade" are often used to designate the quality of the plastic. These terms are quite misleading and indicate very little, since no standards have been established or accepted for the classifying of plastic materials to be used in pharmacy or medicine.

One other catch-phrase often employed—at least in informal conversation—by certain manufacturers and distributors goes something like this: "This device should not be used with those drug products which may be incompatible with it." A profound statement, to say the least, but who is to know what those incompatibilities are since many drug-plastic incompatibilities cannot be detected by visual inspection. Fortunately, the more respected companies do not play this game but are at a loss to prevent the less ethical firms from pursuing such practice.

For the past four years we have been studying the effect plastics materials may have on drug products. Throughout these various studies several hundred drug products have been used. These were kept in contact with a variety of plastics materials either as part of a device for the administration of a drug or alone. The results indicated that a number of incompatibilities had occurred. Some of these incompatibilities were readily detected just by visual examination while others could be ascertained only by analytical procedures. To dramatize that drug-plastic interaction may occur, it may be well to summarize in the next several paragraphs a number of these incompatibilities. For the most part, these have been taken from our own laboratory, but other examples which have been brought to our attention have been included.

Those plastics materials which require one or more ingredients beside the polymer are being used as flexible tubings for the administration of drugs or nutritional products. One such case in point is the use of polyvinyl chloride as tubing material. Our studies have shown that every polyvinyl chloride tubing we have tested which is claimed to be a "medical grade" tubing or tubing to be used for the administration of a drug or nutritional product will leach a constituent to an aqueous system if that system contains 50% or more of alcohol, propylene glycol or polyethylene glycol. Since there are literally hundreds of formulations for polyvinyl chloride and since the plastic manufacturer may be reluctant to reveal his formula, it may be difficult or at least very time consuming to isolate and identify the "leached" constituent. It should be kept in mind that a number of injectable products contain the above solvent system and there may be no visual sign to the clinician or nurse that leaching has taken place in most instances.

Parenteral product	*Description of incompatibility*
Benzyl Benzoate	Tubings dissolved
Compazine	Solution developed a color
Decholin Sodium	Solution developed a color
Liver Injection	Solution became lighter
Polio Vaccine	Solution became lighter
Procaine HCl	Tubing stained yellow
Pronestyl HCl	Tubing stained yellow
Sodium Iodide	Tubing stained yellow
Sodium Lactate	Solution developed a color
Sodium para-Aminohippurate	Solution developed a color

In another series of experiments with various polyvinyl chloride tubings, we found the following incompatibilities. (Above—*Ed.*)

In many instances these incompatibilities occurred with only one type of PVC tubing. This is quite an important point and indicates that one cannot intuitively guess that a reaction will or will not take place with PVC and a drug product.

Several incompatibilities were noted when three types of plastic syringes (PE, polystyrene, and nylon) were tested with a num- **(To page 189)**

Molding New Ideas Into Plastic

These diagrams show how Minnesota Plastics, a custom molder, designed, engineered, and mass produced a battery cap that guarantees protection from "battery blow-outs"

Two-piece, patented, plastic cap is machine assembled. Prongs on lid snap out tight after insertion through bottom slot. Assembled cap is shown below.

Note opening of bottom air slot after insertion of prongs. If bottom slot is too small or absent, breakage occurs and cap is automatically rejected. Proper gas passage is thus guaranteed on all finished vents.

Pressures created by gases formed during battery charging can cause auto batteries to blow out. An escape vent in the battery cap is supposed to prevent this.

But in the process of manufacturing conventional plastic battery caps, these vents sometimes fill in. And despite the most thorough inspection systems, some defective caps find their way onto batteries. The result: a blown-out battery for the user and embarrassing explanations for the maker.

Could Minnesota Plastics make a better battery cap asked one of our customers. A foolproof cap? One so good that not one in total production would go wrong?

Minnesota Plastics answered by engineering the entirely new cap idea you see on this page. Ingenious, low-cost, *guaranteed*. This two-piece plastic cap *must* have an open air vent or it cannot be assembled. It is now being mass produced only by Minnesota Plastics.

This story shows why Minnesota Plastics is more than just a molder of plastics. Here is a complete plastics molding service that works as if it were your own department. Use it to save yourself time and money . . . and to make your product better. Write or wire Minnesota Plastics today.

mpc

PIONEER MANUFACTURER OF NEW PRODUCTS IN PLASTIC

Minnesota Plastics Corporation

45 EAST MARYLAND AVENUE • SAINT PAUL 17, MINNESOTA

NEW MACHINERY-EQUIPMENT

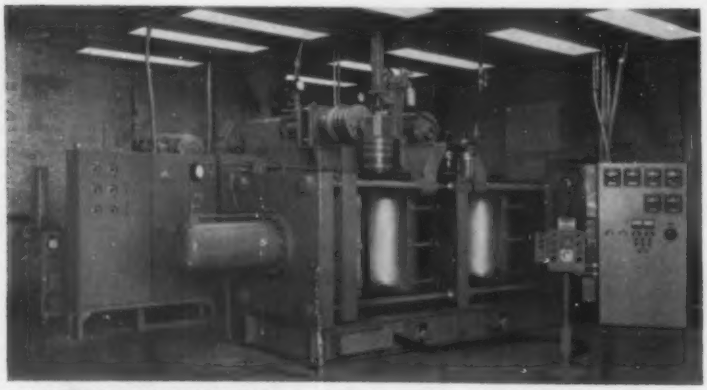
Specifications, claims made, and prices appearing in these pages are those of the manufacturers or sellers of the machinery and equipment described, or their agents.*

Giant blow molder

The largest blow molding machine we have reviewed to-date, the Engman machine, is capable of handling 3000 lb. of plasticated material per hour, although to date it has not been used with extruders capable of delivering that amount of material. In recent molding trials, 55-gal. drum liners, about 0.1-in. thick and weighing 12 lb. each were made in about 3 to 4 min., each using a 3½-in. extruder rated as capable of delivering 600 lb. of material per hour. It is estimated that with an 8-in. extruder a total output of 30 drum liners per hour could be attained. Drum liners are blown from 8-in.-diameter parisons ⅜-in. thick weighing about 25 lb., including trim scrap. To deliver the parison and place it in blowing position before excessive cooling takes place, a ram accumulator system is used to actually push the parison through the die; the accumulator is filled prior to each shot by the extruder. To keep the parison from stretching and necking down excessively, a rising table (coordinated with the parison's rate of travel) supports it from the time it issues from the die until it is in position to be clamped in the mold for the blowing operation. Clamping and accumulator rams as well as the parison support table are hydraulically actuated. All heaters are of the electrical resistance type. Detailed machine specifications are shown in the accompanying table. *Williams-White & Co. and Eclipse Plastic Machinery & Mfg. Corp., Moline, Ill.*

Specifications: Engman blow-molding machine

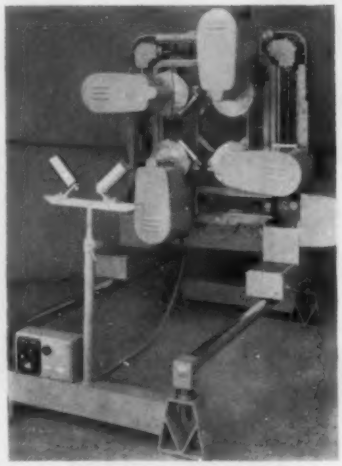
Max. capacity of clamps, tons	80
Max. stroke of clamps, in.	24
Max. daylight, in.	50
Area of platens to clear column nuts, in.	35⅝ by 50
Distance between columns, in.	38
Overall area of platens, in.	50 by 50
Clamp fast close speed, in./min.	131
Clamp pressing speed, in./min.	20
Clamp return speed, in./min.	129
Max. capacity of accumulators, lb.	25
Stroke of accumulator, in.	10
Dia. of accumulator, in.	8
Accumulator close speed (max.), in./min.	112
Accumulator open speed (max.), in./min.	220
Die head lateral movement (max.), in.	4
Die head vertical adjustment, in.	2



ECLIPSE-WILLIAMS-WHITE blow molding machine with 55-gal. drum liner molds mounted on platens. Ram-accumulator is shown above blowing station, left.

Pipe cutter

This cutter automatically cuts plastic pipe as it is continuously extruded without deforming the pipe or the resulting cut. Capable of cutting thin wall pipe from 3.937 to 19.685 in. in diameter, four circular saws (5 in. in diameter for tubes 3.937 to 7.874 in. in diameter and 9.8425 in. in diameter for tubes 7.874 to 19.685 in. in diameter) moving counter-clockwise around a track, each makes one straight cut in the pipe wall for each complete pipe cut. The cutting edge of each saw follows a straight path lying on a chord of the pipe circumference. The path of the cutting edges of the saws thus inscribes a square within the circular pipe wall; such paths intersect and complete the severance of the pipe. After one pipe cut-off is made, the saws do not return to their starting point but continue to move counter-clockwise around the square track on successive pipe cut-offs, thus any one saw does not return to its starting position until four pipe cut-offs are completed. While a pipe cut-off is being made, the entire saw carriage assembly is clamped to, and automatically advances with, the moving pipe being extruded. After the cut the saw carriage retracts along the pipe toward the extruder prior to the next cut-off. The total working cycle time is about 30 sec. for large pipe and shorter when cutting small diameter **(To page 50)**



PASQUETTI cutter automatically cuts plastic pipe as it is continuously extruded. Four circular saws travel counter-clockwise around track.

* Prices are deemed to be F.O.B. sellers' plants (unless otherwise stated), are for "standard" models, and are subject to change without notice. The publishers and editors of MODERN PLASTICS do not warrant and do not assume any responsibility whatsoever for the correctness of the same or otherwise.

"We get round-the-clock automation with VAN DORN presses"

These Van Dorn presses have produced millions of flexible Vinyl feet for Rubbermaid dish drainer baskets in the last two years. The operation is *fully automatic,* with presses running 3 shifts on a continuous basis.

Rubbermaid uses multi-cavity, tunnel gate molds, and the original molds are still in use. On the infrequent occasions when the job needs attention, the operator of a large machine nearby can readily come over between cycles of his own press.

You, too, can save time and money with Van Dorn automatic, 2½ oz., high production injection presses. Write for detailed literature.

THE Van Dorn IRON WORKS CO.
2685 EAST 79TH STREET • CLEVELAND 4, OHIO

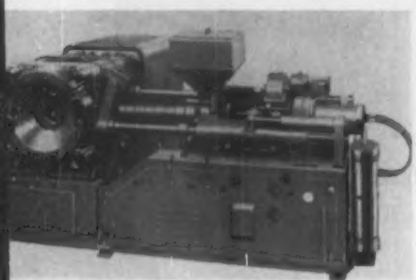
NEW MACHINERY-EQUIPMENT

(From page 48)

and/or thin wall tubes. *Carlo Pasquetti & Co., Sanvito Silvestro 103, Varese-Masnego, Italy.*

Injection machine

For applications requiring injection on the parting line of the mold, Stübbe reciprocating screw preplasticating injection machine Models S350/550 VE, S550/725 VE, and S850/1200 VE are designed so that the injection half of the machine can be swung around 90° to operate at right angles to the mold-clamping half of the unit. Operating the press in such fashion is claimed to be an advantage in the molding of parts with large projected areas (television screens) and in achieving better mold flow patterns for the molding of stress-free flat pieces. The standard machine is supplied with the clamp and injection unit in line. For operation in L-form an adapter is required which is supplied at extra cost. Detailed specifications are shown in the accompanying table. *Albert Stübbe Maschinenfabrik, Vlotho/Weser—Kalldorf, Germany.*



STUBBE Model S850/1200 VE reciprocating screw preplasticating injection machine shown arranged for injection on the mold parting line. Note adaptor mounted on tie bars of the mold clamping unit.

Water chiller

Multitem Model TP is a temperature control unit that provides low-temperature rapid cooling for injection molding, extruding, or other related forming processes. It is a self-contained chilling system, including water pump and water storage tank ready for connection to process. Individual units can be installed to meet initial needs and more units added for future increases in production. Also available is Model S, without pump or tank, designed for use with a central water pump and collection tank. Large thermometer on TP models shows temperature at a glance. Chilling unit and all piping are insulated against condensation. Refrigerant is non-toxic and refrigerant control valves are standard on all models. Units can be mounted on floor or ceiling. The unit includes compressor, condenser fan, fin condenser, chiller, and temperature controls. Centrifugal pumps are used on Model TP, and self-lubricating motor and impeller are removable without disturbing piping. Temperature ranges are to order. *Application Engineering Corp., 3811 Podlin Dr., Franklin Park, Ill.*

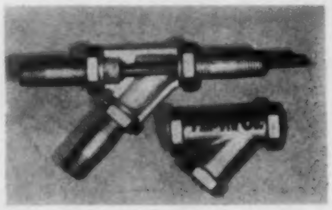
Specifications: Albert Stübbe injection molding machines

	S350/550VE	*S550/725VE*	*S850/1200VE*
Screw-piston diam., in.[a]	3	3⅜	4 5/16
Plasticating capacity lb./hr.[b]	110	132	187
Shot volume, max., cu. in.	34.8	44.0	97.5
Injection pressure, max., p.s.i.	11,500	13,500	9,000
Shots per min.[c]	5½	5	3½
Screw speed range, r.p.m.	15 to 90	15 to 90	12 to 85
Heating power, kw.	9.5	9.5	16.5
Projected mold area, max., sq. in.	132	186	310
Clamp force, tons	250	350	500
Mold opening, max., in.	16.5	19.7	29.6
Mold thickness, min., in.	10.4	15.75	15.75
Mold thickness, max., in.	16.5	23.6	23.6
Clearance between tie bars			
Horizontal, in.	17.35	19.7	25.6
Vertical, in.	11.8	17.35	25.6
Motor, hp.	20	25	30

[a] Only largest screw diameter available shown. Additional smaller screw sizes available, 1 for S350/550VE, 2 for S550/725VE, and 3 for S850/1200VE. [b] In polystyrene. [c] Number of shots depends on volume of molded piece, materials, working conditions, and mold design. Actual values above and below averages shown.

Die cooling fitting

In cases where it is impractical or impossible to have through water lines, the Par-Vin single-return water line fitting can be used to direct water to any portion of the mold cavity or cores simply by drilling a hole in the area that is running too hot and adding the fitting. Cooling can then be directed to areas such as gate, runner, heavy sections, and cores. Priced under $2. *Par-Vin Co., 29 Union St., Batavia, N. Y.*



PAR-VIN single-return water line fitting can be used to direct water to any portion of the mold cavity.

Heat sealer

Called the Sealmaster 16TS Series, this equipment is a semi-automatic air operated sealer that uses a rapid heating and cooling action to achieve optimum seals with PE and other films. The rapid heating effect is achieved by pulsing a thin ribbon of high-temperature alloy with a high current for a short time interval. After the heating current is cut off, the extremely low thermal capacity of the alloy ribbon results in an effective reversal of heat flow and a resultant rapid cooling action. Specifications are: Maximum length, 16½ in.; sealing cycle, ½ to 2 sec.; size, 8 by 8 by 20 in.; power, 110 to 120 v. a.c.; and air pressure required, 60 p.s.i. Price, $395 F.O.B. Mfr. *Weldotron Corp., 841 Frelinghuysen Ave., Newark 12, N. J.*

Granulator

The Model XD-2 extra-heavy-duty twin-drive plastics granulator has been expressly designed to handle tough new resins such as acetals, polycarbonates, and nylons. Powered with a 7½ hp. motor, the grinder has double flywheels for extra impact. Double V-belt drives minimize rotor twist and belt slippage. "Big bite" two-bladed rotor is used **(To page 52)**

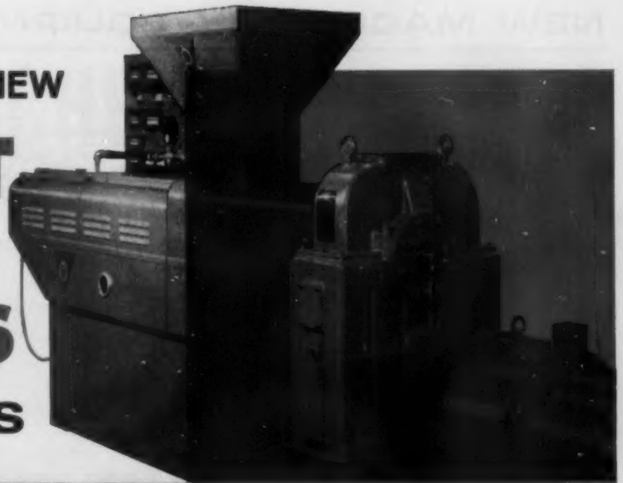
Years Ahead! The VERSATILE, NEW

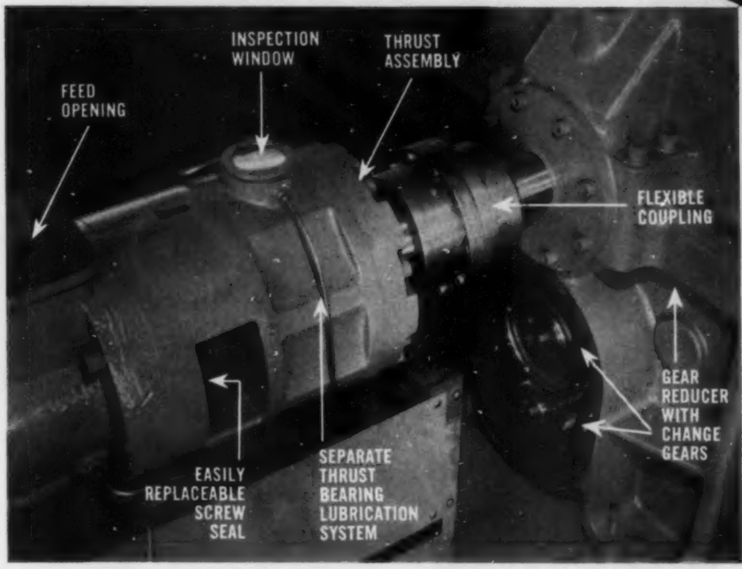
PRODEX HT

HIGH TORQUE

EXTRUDERS

with CHANGE GEARS





BOTH HIGH AND LOW VISCOSITY MATERIALS CAN NOW BE EXTRUDED AT MAXIMUM H.P. EFFICIENCY AND OUTPUT

LOOK AT THESE HORSEPOWER RATINGS

EXTRUDER SIZE	HORSEPOWER RATINGS
1¾"	7½-10
2½"	20-40
3½"	40-100
4½"	60-150
6"	125-200
8"	200-400

The versatile PRODEX **HT** EXTRUDER gives you the opportunity to quickly select the optimum reduction ratio and screw speed necessary to achieve the highest possible production rate for each extrusion job.

This is now possible because the new PRODEX gear reducer with change gears is capable of transmitting as much torque as the screw can handle. All plastic materials can now be run at maximum output and horsepower efficiency of the motor drive.

Let us show you **all** the new features incorporated in the new PRODEX **HT** EXTRUDER. See it perform with your own materials in our customer service laboratory. Write or phone for appointment.

ONLY PRODEX HAS ALL THESE DESIGN FEATURES

- GEAR REDUCER: Vertical design for space saving and extra ruggedness. Herringbone gears thruout.
- CHANGE GEARS: For selection of the optimum reduction ratio and screw speed at any time.
- SEPARATE THRUST ASSEMBLY permits easy accessibility and maintenance. The spherical roller thrust bearing used in all machines is self aligning.
- SEPARATE THRUST HOUSING LUBRICATION SYSTEM: Oil is continuously circulated by a gear pump through a filter cartridge. Best bearing oil can be used. No compromise between gear and bearing lubricant as in other machines.
- FLEXIBLE COUPLING to absorb thermal expansion misalignment between gear reducer and extruder. Avoids any possible thrust load on gear reducer.
- FULL DIAMETER SCREW SHANK to handle heaviest torque load.
- INSPECTION WINDOW on thrust assembly housing permits visual bearing and oil feed inspection.
- EASILY REPLACEABLE SCREW SEAL to prevent leakage of dusty powders and for use of vacuum hoppers and melt feeds.
- FEED OPENING: Large rectangular opening with cooling jacket. Permits feed to flow freely.
- SELF CENTERING cylinder front support greatly reduces cylinder and screw wear.
- FULL LENGTH HEAVY MACHINE BASE
- FULLY AUTOMATIC heating and cooling controls.
- SIZES: 1¾" to 8" diam. L/D ratios 20:1, 24:1 and 30:1.
- SINGLE AND MULTIPLE STAGE VENTING
- CONTROLLED PRESSURE VALVING
- INLAY HARD-SURFACED SCREWS (not flame hardened) keep their hardness through highest extrusion temperatures.

Write for illustrated bulletin E-6.

PRODEX —in design and performance ALWAYS A YEAR AHEAD

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NEW MACHINERY-EQUIPMENT

(From page 50)

for round objects; a three-bladed rotor is also available. Throat size is 12 by 12 inches. Tangential cutting action is offered on stationary blades. Cutting chamber is completely dismountable. A special hinged screen cradle permits easy cleaning and a built-in throat clearance bar is provided for safety. Unit is stocked with dual voltage motor wired for 220 v., 60 c.p.s., three-phase power. Price: $1,740 with starter. *Injection Molders Supply Co., 3514 Lee Rd., Cleveland 20, Ohio.*

Long-stroke injection machine

Like the 6/9-oz. forerunner, this 24/32 oz. machine, designated the Lester L-450-24/32, offers the longest adjustable stroke commercially available for this machine capacity —from 30 to 8 in., with a total daylight of 60 inches. Dry cycle of the machine is 7.25 sec. on an 8-in. stroke, 8 sec. on a 20-in. stroke, and 9 sec. on a 30-in. stroke. Mold clearance between beams is 25 in. horizontally by 27 in. vertically. The machine comes complete with additional 3-, 6- and 9-in. spacer rings to allow a minimum height of only 9 in. for greater freedom in mold height adjustment, in addition to the 3-in. central screw adjustment. Clamp is 450 tons. The injection end uses an internally heated cylinder, designed to plasticize 200 lb./hr. of polyethylene or 300 lb./hr. of polystyrene. The cylinder retracts 15 in. for purging. Nominal shot size is 24 oz. on a single feed, and 32 oz. on a double feed, but the machine has produced parts in production weighing over 45 oz. in polystyrene. The machine is adaptable to molding nylon, using a Lester nylon cut-off attachment. A differential (rapid advance) gives the machine high injection and filling speeds. Other standard features of the machine are panel-mounted valving, a 200-p.s.i. pressure system and S.P.I. standard ejection, and low-pressure closing, as well as automatic cycling. *Lester-Phoenix Inc., 2711 Church Ave., Cleveland 13, Ohio.*

Inserts

Taper-Thread inserts designed for fast and easy installation in plastic parts after molding are merely placed in a hole and are ready for use. By the use of exclusive tapered threads, the incoming screw expands the insert and firmly locks the diamond knurls into the hole walls to prevent rotation and pull-out. The amount of expansion and the screw-locking action are easily controlled by the hole diameter. Standard sizes range from 2 to 56 through 10 to 32 and they are made of brass or aluminum. *Fastener Products Inc., 239 Danbury Rd., Wilton, Conn.*

Laboratory roll mill

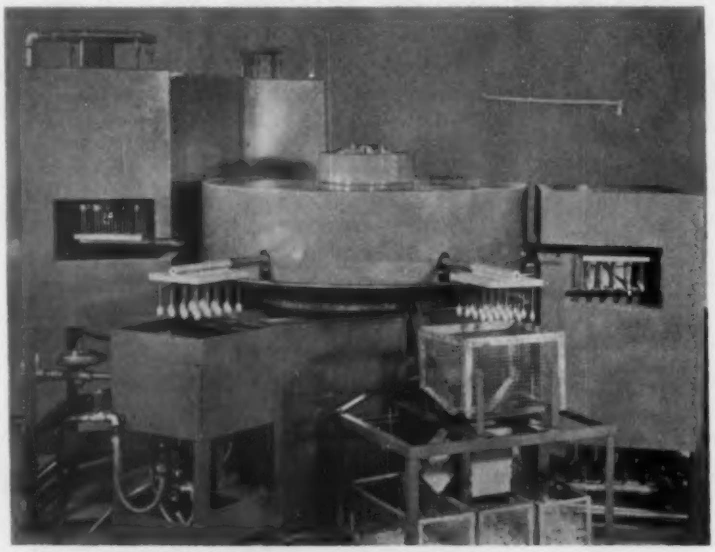
This pilot-size unit, termed the Dilts-JMC All-Purpose Lab Mill, for compounding plastics, has two 6-in.-diameter by 13-in.-long hardened and ground steel rolls operating at a 1.25:1 friction ratio and driven by a 7½-hp. constant speed motor and brake. Rolls are micrometer adjusted with spring return loading. The unit operates at temperatures up to 450° F. using oil, or 350° F. using steam. Movable parts are fully guarded and the mill has safety knee-panel power switches. Optional equipment includes chrome-plated rolls, tilt aluminum guides, variable and dual variable speed drives, transparent atmosphere-control cover, plus additional operator safety equipment. *The Black-Clawson Co., Dilts Div., Fulton, N. Y.*

Dipping machine

Fully automatic, this plastisol dipping machine will produce dipped goods at rates up to 12,000 items/hr. This six-station machine preheats forms, dips, thermosets film, cools, strips and sorts, completing the cycle in as little as 36 seconds. Cycle regulating gages are calibrated in seconds so the time cycle and temperatures can be set exactly. Up to 20 forms may be mounted on each form-carrying plate, and three different items can be made simultaneously and automatically sorted. The operator need not be a technician. His duties are merely to supply the material tank and remove tote boxes full of finished, sorted products. Machine requires floor space of only 8 by 10 ft., and is 5 ft. high. Typical of the products turned out on this machine are grapes, small bulbs, nipples, pen sacs, handlebar grips, chair leg tips, and gloves. *The Akron Presform Mold Co., 2038 Main St., Cuyahoga Falls, Ohio.*

Metal detector

The new EMR Model 200A Metal Detector locates ferrous particles as small as 0.063 in. across or non-ferrous tramp-metal particles about 0.085 in. across in non-metallic materials. It is particularly adapted to finding metal of any kind in plastic strips, sheets, or films moving at web speeds between 1 and 100 ft./min. The Model 200A has a patented control system not found in competitive devices, which permits reliable, stable, unattended operation even during changes in temperature, humidity, and barometric pressure and in the presence of smoke and noxious fumes. The current unit is for use with webs about 3 ft. wide. Other coil-system configurations are available upon request. The overall unit consists of a dust-proof control box and a coil system that comprises a fixed head and **(To page 54)**



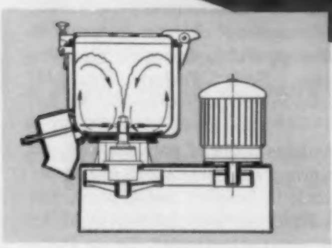
AKRON PRESFORM MOLD automatic plastisol dipping machine will produce dipped goods at rates up to 12,000 items per hour.

—the revolutionary

PRODEX-HENSCHEL MIXER

U.S. Pat. No. 2,945,634

PRODEX HENSCHEL



Hundreds of PRODEX-HENSCHEL MIXERS are being successfully used for...

- ✓ Plasticized Vinyl Dryblending
- ✓ Rigid PVC Dryblending
- ✓ Pigment Dispersion in Polymers
- ✓ Acetate and Butyrate Dryblending
- ✓ Filler Mixing with Thermosets
- ✓ Fibre Mixing with Polyesters
- ✓ Dry Coloring

In the **PRODEX-HENSCHEL MIXER**, a specially designed propeller-like impeller rotates at peripheral speeds of about 150 ft/second. The centrifugal action of this impeller creates a rapid and continuous flow of the mixer charge through the impeller blades. The high impact velocity of the blades and their shearing action break down agglomerates and cause intimate dispersion of all ingredients. The impeller is designed for large energy transfer to the mixer charge so that rapid mechanical heating is also obtainable. The heating rate is controlled by selection of the proper speed on the multiple speed motor drive. Mixing cycles for complete dispersion are usually so short that heat build-up is negligible where it is not desired. The mixers are jacketed for heating or cooling, and a stock temperature indicator is provided for continuous observation of the batch temperature.

PRODEX-HENSCHEL MIXERS ARE AVAILABLE IN FOUR SIZES

MODEL	2JSS	18JSS	35JSS	115JSS
TOTAL CAPACITY (cu. ft.)	0.37	2.7	5.3	17.5
USEFUL CAPACITY (cu. ft.)	0.25	1.8	3.5	11.5
MOTOR H.P.	2	15	32	92

Also available in vacuum-tight construction for vacuum extraction with large material surface exposure and continuous agitation.

The **PRODEX-HENSCHEL MIXER** is cleaned in minutes, due to its smooth interior design. All contacting surfaces are made of stainless steel. It is easily loaded and discharged while running.

See the **PRODEX-HENSCHEL MIXER** perform with your material. Write or phone for an appointment.

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NEW MACHINERY-EQUIPMENT

(From page 52)

a movable head. The coil system provides inspection apertures of up to 11 inches. *Electro-Mechanical Research Inc., Sarasota, Fla.*

Roll nip and crown checker

For testing both the nips and crowns of rubber covered rolls (such as are used in plastic web processes) the Nip Width Tester consists of 6-in.-wide rolls of specially-designed embossed aluminum foil of exact thickness. A strip of the foil is placed across the face of the rubber roll to be checked and is fastened in place with strips of pressure-sensitive tape. Reduced pressure is applied to engage the rolls and bring both ends into contact evenly. As the pressure is increased, the embossed foil is pressed flat in the nip so that, in effect, a picture is taken of the nip contact area. The foil pattern provides a sharp, clear impression which permits measurements to within 0.01 inch. Extreme variations are immediately seen. *Stowe-Woodward Inc., Newton Upper Falls, Mass.*

Multi-Rez-Processor

The Multi-Rez-Processor, designed for mixing and dispensing reactive resin mixes, is shipped ready to use; simply fill reservoirs, plug in and start production immediately. Proportion accuracy of the two components is maintained through mechanical linkage operating positive displacement pumps. The ratio is 100 parts resin per 10 to 100 parts catalyst. This is set at the factory but may be easily changed in the field. The resin and catalyst are pumped through a duplex manifold and dispensed through integral cut-off valves. The dispenser can be operated by rotating or oscillating the knob handle as desired. The resin-mix is thoroughly stirred by a motorized mixer having a Teflon impeller. There are no cleaning or purging problems, and short pot-life resin mixes can be easily handled in two 3-gal. seamless reservoirs on a stand above the steel base. Unit is 16 by 30 by 20 in. high, and weighs 60 pounds. *CPM Special Machinery Corp., 324 Butler St., Brooklyn 17, N. Y.*

Fabric impregnator

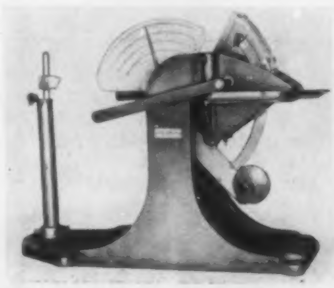
For the impregnation of various fabrics with liquid resins, the Walco Model 60-U-R-2 machine can be used in the preparation of glass fabrics prior to laminating or other

WALCO Model 60-U-R-2 fabric impregnator showing unwind roll, impregnating trough, adjustable squeeze rolls, and rewind roll at left. Rewind roll could be replaced by oven for fabric requiring drying cycle.

processes. Unit comes complete with unwind, rewind, and squeeze rolls. Variable speed drive pulls cloth through submersion bar in impregnating tank from unwind unit, on through adjustable squeeze rolls and onto rewind unit. Adjustable wooden cones hold cloth rolls on interchangeable shafts easily accessible for removing. This unit available in widths up to 60 inches. *L. R. Wallace & Co., 172 N. Vernon Ave., Pasadena, Calif.*

Puncture tester

TMI Beach Puncture Tester, developed by Dr. Ralph L. Beach of the General Electric Co., can be used in special cases to test plastic film and other materials. The normal scale reading is from 0 to 1280 in. oz./in. of tear. For heavier materials a secondary release can be used which reduces the pendulum energy to slightly less than one third. This tester has become a National Standard in South Africa and meets the ASTM and TAPPI Standards. Measurements obtained from the Tester are used to check incoming material specifications. The data is also useful in evaluating the serviceability of various designs and materials. *Testing Machines Inc., 72 Jericho Turnpike, Mineola, N. Y.*



TMI Beach puncture tester can be used to test plastic film and other materials.

Grinding kit

For roughing and finishing plastics, the Skil Model 412 kit includes a pneumatic grinder and nine Perma-Grit tungsten-carbide rods and rasps with up to 20 times the life of conventional grinding rasps. They are made specifically for grinding and finishing a wide range of plastic materials in sign manufacturing, in plastics molding (pattern and model makers), in boat fabrication, and in plastics operations in aircraft and automotive plants. The nine tools come in several shapes, sizes, and grits including 4 cup rasps, 2 cone-shaped rotary rasps, 2 rods, and a wheel rasp. Each tool has tungsten-carbide abrasives permanently bonded to steel. Grinder weighs 1⅛ pound. Price: $135. *Skil Corp., 5033 N. Elston Ave., Chicago 30, Ill.*

... Machinery in brief

▶ Designed for use with Scott Model CRE Electronic Testers and Scott Accr-O-Meter Conversion Kits, the Specimen Dimension Compensator now provides a fast, simple, accurate means of obtaining tensile test recordings *direct* in p.s.i., kg./ sq. cm., or other selected bases by automatically adjusting for dimensional changes in specimen thickness, width, diameter, or cross-section. *Scott Testers Inc., 101 Blackstone St., Providence, R. I.*

▶ Articles made of polyethylene and polypropylene, heretofore extremely difficult to lacquer, bond, print, and metallize, can now be processed by a 30-sec. pretreatment dip in Poly-Prep followed by water rinse. A new concept in treating these inert plastics, Poly-Prep is not a coating but a chemical which activates the surface of both polyethylene and polypropylene—promoting adhesion. *Chemclean Products Corp., 15-08 121 St., College Point 56, N. Y.*

▶ The Kensol 36T power press can now be equipped with a left to right pull, air operated roll leaf attachment in either the 6- by 8-in. or 5- by 12-in. sizes. The attachment has a 1-in.-diameter air cylinder, four-way air valve, on-off valve, roller speed controls; also available on Kensol 50-, 60-, or 110-heavy-duty presses. *OlsenMark Corp., 124-132 White St., New York 13.*—End

- **Hauls all profiles, tubes, cables without set-up**
- **Will not scratch, mar, mark or dull any finish**
- **Infinitely variable speed ranges from 4" to 445 ft/min.**
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WORLD-WIDE PLASTICS DIGEST*

Abstracts from the world's literature relative to plastics. For complete articles, send requests direct to publishers. List of addresses is at end of this section.

General

Impact of petrochemical development on the plastics industry. H. M. Stanley. Plastics Inst. Trans. and J. *28,* 110-23 (June 1960). The synthesis of chemicals for producing resins from petroleum is reviewed.

High temperature plastics: Where do we stand? W. Brenner. Materials in Design Eng. *51,* 132-34 (June 1960). Progress in developing organic, semi-organic, and inorganic polymers for long-time service at 500° F. and above is assessed.

Materials

Inorganic polymers. F. G. R. Gimblett. Plastics Inst. Trans. *28,* 65-73 (Apr. 1960). Phosphonitrilic chloride polymers have good thermal stability and withstand temperatures up to 350° C. in vacuo before appreciable breakdown occurs. This behavior is vastly superior to that of the more common elastomers and is comparable with that of Kel-F under similar conditions. Breakdown in the presence of moisture is linked with the easy removal of the chlorine atoms in the chain.

Synthesis of polymers on the basis of β-chlorovinylketones. A. N. Nesmeyanov, M. I. Rybinskaia, and G. L. Slonimskii. Vysokomolekuliarnye Soedineniia *2,* 526-28 (Apr. 1960). A method of synthesizing chelate polymers on the basis of β-chlorovinylketones is reported. The polymers are stable at high temperatures, do not melt, are insoluble, and have unusual magnetic and electrical properties.

Transparent cold-shock-resistant epoxy casting resin. B. Carroll and J. Smatana. Sandia Corporation Reprint SCR-173, 34 pp. (Apr. 1960). The synthesis and properties of a transparent cold-shock-resistant epoxy casting resin are reported. Report available from Office of Technical Services, U. S. Dept. of Commerce, Washington 25, D. C., for $1.00.

The use of extenders in flexible urethane foams. T. H. Ferrigno. SPE J. *16,* 638-40 (June 1960). Aluminum and magnesium silicates, silica, mica, calcium carbonate, and similar inorganic materials are evaluated for use as extenders in two types of polyethers, a prepolymer, and a "one-shot" foam. The best extender for both systems is 4.8 micron aluminum silicate. Fine particle extenders are reactive in the prepolymer system and require surface modification to be useful. Coarse particle extenders are required in the "one-shot" system since fine particles inhibit polymerization.

Foam molding techniques and molded styrene containers. N. A. T. Clark. Canadian Plastics *1960,* 52-5, 57 (Apr.). Various recommendations for the use of foamed polystyrene are given. Special emphasis is given to the molding of containers. The relation of strength properties to foam density is discussed. Methods are described for determining cushioning factors for foam containers.

Polypropylene by the Ziegler process. R. A. Labine. Chem. Eng. *67,* 96-99 (June 27, 1960). A partial process flowsheet for a recently opened 40-million-pound-per-year polypropylene plant is presented. The catalyst is reported to have ten times the activity of the original Ziegler catalysts and polymerizes C2 through C8 olefins; the process reportedly simplifies catalyst removal. The plant consists of four major sections: catalyst preparation, polymerization, polymer separation, and polymer finishing.

A guide to potting and encapsulation materials. C. V. Lundberg. Materials in Design Eng. *51,* 123-27 (May 1960). The factors to be considered in selecting a potting or encapsulating material and the materials that are available are described and evaluated.

Molding and fabricating

Mechanical strength of polyester moldings in relation to curing rate and type. H. Schirmer. Kunststoffe *50,* 388-90 (July 1960). Techniques for obtaining the maximum strength in glass fiber-polyester laminates made by the cold-setting hand-lay-up process are described. Final tempering is very effective.

Epoxy parts cast by centrifugal force. R. Buenger. Product Eng. *31,* 45 (May 23, 1960). Centrifugal casting of epoxy parts in epoxy molds is described. This method allows economical production of up to about 500 parts.

Welding of rigid thermoplastic high polymers. N. A. Grishin and S. S. Voyutskii. Vysokomolekuliarnye Soedineniia *1,* 1778-94 (Dec. 1959). A study was made on the effect of welding conditions on the bond strength of welded polymers. The strength of the weld increases with increasing pressure and duration of the welding process, approaching a given limit. This is evidence of the diffusion character of the process. The weld strength increases with the welding temperature.

Applications

Polyethylene for radiation shields. Insulation *6,* 43 (May 1960). Polyethylene panels over 1-in. thick reportedly provide excellent protection from neutron bombardment and weigh much less than conventional materials.

Plastics in packaging. Plastics (London) *25,* 171-94 (May 1960). This special survey of plastics in packaging consists of 18 short articles reviewing present and potential applications. Among the topics discussed are new packaging methods, package design, packaging machinery, skin and blister packaging, bottles and collapsible tubes, and the use of rigid films, laminated films, and cellular plastics. Specific items include the uses of polystyrene, high density polyethylene, and similar plastics films.

Behavior and properties of PVC floor coverings. E. Fortun. Kunststoffe *50,* 417-24 (July 1960). Polyvinyl chloride plastic floor coverings are classified according to types of use. Their properties, measured by standard test methods, are reported.

Formulations and quality control in polyurethane propellants. H. E. Marsh, Jr. Ind. Eng. Chem. *52,* 768-71 (Sept. 1960). Propellant elongation correlates with polymer network parameters. Basic parametric relationships are rederived to account for monofunctional impurities. About 5% excess isocyanate yields maximum cross-linking efficiency. Tensile capacity, a useful quality, is used instead of tensile **(To page 58)**

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(From page 56)

strength and elongation. Propellant binder formulation specification by ratio of isocyanate to hydroxyl and average molecular weight between branch sites is much more general than weight recipe. Formulation improvements are readily detected by tensile capacity plots.

Chemical principles of solid propellants. E. Mishuck and L. T. Carleton. Ind. Eng. Chem. *52*, 754-60 (Sept. 1960). The chemical principles that govern all aspects of manufacture and use of modern solid propellants were surveyed. Thermochemical requirements favor composite propellants with high heats of reaction, which burn to stable products of low molecular weight. These are preferably formed by casting and case bonding. Uncured slurries must have rheological properties that permit mixing and gravity casting. Curing by polymerization requires low exothermal heats, low shrinkage, and late gelation. The resulting cured structure must have special mechanical properties, and must be resistant to physicochemical damage on aging. Efficient combustion requires careful regulation of burning rates and control of erosive and resonant burning. The principles are highly interdependent, and all must be considered in formulating propellants.

Plastics for rocket motor nozzles. G. Epstein and H. A. King. Ind. Eng. Chem. *52*, 764-67 (Sept. 1960). Reinforced plastics can provide relatively lightweight nozzles for rocket motors. It is desirable to employ a test method that simulates the operating conditions, in order to establish optimum materials processing and construction parameters. A small rocket motor test facility, the SPAR, was designed and constructed. Test specimens are successfully evaluated in the form of nozzles mounted directly into the aft end of the motor. The type of resin and reinforcement and orientation of the reinforcement are significant performance factors. Heat-resistant resins and fiber reinforcements are generally most suitable in reinforced plastic nozzles. High-melting refractory fiber reinforcements are preferable to lower-melting and organic fibers; and edge-grain orientation of reinforcements is desirable.

Plastics as heat insulators in rocket motors. W. C. Hourt. Ind. Eng. Chem. *52*, 761-63 (Sept. 1960). An analytical method is described for predicting the performance of plastic insulation materials in the high temperature environments of rocket chambers. Various service conditions to which plastic insulators are subjected were investigated and their effect on the physical and thermal response of the plastics was observed. A solution to a mathematical model describing thermal degradation of plastic material shows that observable performance variables are functions of the thermal properties of the plastic insulator. The extent of thermal degradation depends upon the square root of exposure time.

Construction and repair costs cut by epoxy adhesives in concrete. R. W. Gaul and A. J. Apton. Adhesives Age *3*, 24-27 (May 1960). Cracks in concrete are repaired and steel reinforcing rods are bonded to concrete with epoxy resinous adhesives. Epoxy plastic overlays are also used on concrete surfaces.

Properties

Study of polymeric materials by nuclear magnetic resonance. J. G. Powles. Polymer *1*, 219-65 (June 1960). The application of nuclear magnetic resonance techniques to the study of polymeric materials is reviewed. The aspects of both theory and experiment in nuclear magnetic resonance which are of particular importance in polymer studies are emphasized. A bibliography of all the papers on nuclear magnetic resonance in polymers is given. A variety of effects in polymer science to which nuclear resonance has made a contribution are discussed to illustrate the scope and applicability of the method.

Specific heats. H. Wilski. Kunststoffe *50*, 282-83 (May); 335-36 (June 1960). The mean specific heat and enthalpy of high-density polyethylenes (0.948 to 0.963 g./cm.^{3}) and isotactic polypropylene are reported. Heats of fusion are calculated.

Tracking as a possible cause of explosions. E. F. Richter and W. Knittel. Kunststoffe *50*, 267-76 (May 1960). Methods for determining the electrical track resistance of plastic surfaces are reviewed. Conclusions regarding the mechanism of tracking are drawn from oscillographic photographs of tracking currents. An experimental investigation of the flammability of tracking currents and their premature discharge in a toluene vapor-air mixture is reported. No correlation between the flammability and tracking resistance was observed for 57 insulating materials.

Structural design of plastics. E. Baer, J. R. Knox, T. J. Linton, and R. E. Maier. SPE J. *16*, 296 (Apr. 1960). Engineering principles for the structural design of plastics are presented. Interpretation of results obtained from uniaxial tests involving stress-strain data, and the importance of creep and relaxation to plastics design are discussed. Recommended practices for using mechanical properties and concepts in the design of plastics are described.

Tensile and impact strengths of ten epoxy adhesives. M. J. Bodnar and R. F. Wegman. Materials in Design Eng. *51*, 136-38 (May 1960). Tensile and impact data of 10 commercial room-temperature epoxy adhesives at −65, 73.5, and 160° F. are presented and discussed.

Creep characteristics of compression-molded polyethylene. G. R. Gohn and J. D. Cummings. ASTM Bull. No. 247, 64-68 (July 1960). The creep resistance of compression-molded polyethylene appears to be improved by decreasing the melt index of the raw material used in the preparation of the compound. Creep was observed at all stress levels studied, even at stress levels as low as 50 p.s.i. Periods in excess of 40,000 hr. are required to establish constant creep rates at all but the lowest stresses studied; at the higher stress levels minimum creep rates are not established even after 70,000 to 95,000 hr. of continuous loading. Equations presented in the literature for the calculation of long-time creep from tests of short duration (100 to 1000 hr.) will give erroneous results if one of the parameters used for such extrapolation is a constant creep rate as determined from the short-time test, since these data give additional evidence that constant creep rates are not established in such short-time intervals.

Crystallographic data for various polymers. R. L. Miller and L. E. Nielsen. J. Polymer Sci. *44*, 391-95 (June 1960). The available crystallographic data for crystallizable polymers are presented in tabular form.

Testing

Measurement of oxygen permeability. A. A. Taylor, M. Karel, and B. E. Proctor. Modern Packaging *33*, 131 (June 1960). In food packaging the degree of oxygen permeability is a decisive factor in (To page 179)

U.S. PLASTICS PATENTS

Copies of these patents are available from the U. S. Patent Office, Washington, D. C., at 25¢ each.

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Extrusion. D. B. Sherman (to Owens-Illinois). 2,944,288.

Pre-expanded thermoplastic. L. S. R. Norrhede (to Isoleringsaktiebolaget). 2,944,292.

Polymeric surfaces. F. J. Bourbeau, J. Greenhalgh, and C. F. Valle Jr. (to Polaroid). 2,944,294.

Tubular articles. E. C. Bernhardt, J. A. Boxler, and P. E. Prince (to Du Pont). 2,944,298.

Articles of controlled density. G. Mason (to Modern Plastics Research). 2,944,821.

Reinforced pipe. A. C. Anderson (to A. O. Smith). 2,944,839.

Acetone-formaldehyde-glycol resins. M. T. Harvey and P. L. Rosamilia (to Harvel). 2,944,989.

Vinylpyridine polymer. G. Kraus (to Phillips). 2,944,992.

Reinforced plastic. F. G. Singleton and K. A. Schafer (to H. H. Robertson). 2,944,994.

Hexafluoropropylene-vinylidene fluoride elastomer. L. P. Dosmann and G. L. Barnes (to U. S. Rubber). 2,944,995.

Epoxy composition. M. B. Berenbaum (to Thiokol). 2,944,996.

Chlorotrifluoroethylene polymer. S. Gates and D. H. Mullins (to Union Carbide). 2,944,997.

Polyurethanes. E. C. Buxbaum (to Du Pont). 2,944,998.

Light-stabilized resins. F. J. Abbruscato (to American Cyanamid). 2,944,999.

Polyester with stabilizer. S. H. Long, J. W. Tamblyn, and L. D. Moore Jr. (to Eastman Kodak). 2,945,000.

Copolymers. M. M. Olson and R. M. Christenson (to Pittsburgh Plate Glass). 2,945,003.

Epoxide resins. S. O. Greenlee (to Devoe & Raynolds). 2,945,004.

Lactone-derived resins. M. DeGroote and K. T. Shen (to Petrolite). 2,945,005.

Carbonyl polymers. L. M. Minsk (to Eastman Kodak). 2,945,006.

Spiroglycol polymers. J. R. Caldwell, R. Gilkey, and B. S. Meeks (to Eastman Kodak). 2,945,008.

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Polyesters. A. R. Berens (to B. F. Goodrich). 2,945,012.

Interpolymers. J. B. Ott (to Monsanto). 2,945,013.

Boric ester copolymers. J. Hartley and J. D. Downer (to Shell). 2,945,014.

U.S. Pats., July 19, 1960

Thermoplastic pipe. J. C. Houston (to Koppers). 2,945,258.

Foam plastics. A. A. Aykanian and F. A. Carlson, Jr., (to Monsanto). 2,945,261.

Reinforced plastics. M. Petty (to Hudson Engineering). 2,945,262.

Polyolefins. A. A. Miller (to General Electric). 2,945,792.

Irradiating resins. A. S. Cummin (to Congoleum-Nairn). 2,945,795.

Conductive plastic. M. A. Coler. 2,945,825.

Interpolymers. E. C. Chapin and R. E. Smith (to Monsanto). 2,945,835.

Styrene and ethylene-vinylene carbonate copolymer. I. O. Salyer and J. A. Herbig (to Monsanto). 2,945,836.

Polymethacrolein. R. L. Eifert and B. M. Marks (to Du Pont). 2,945,837.

Polysiloxanes. M. Prober (to General Electric). 2,945,838.

Styrene homopolymers. J. A. Blanchette (to Monsanto). 2,945,839.

Polyethylene terephthalate. J. F. L. Roberts, H. J. Twitchett, and A. S. Wild (to Imperial Chemical). 2,945,840.

Boric acid and diisocyanate copolymers. R. S. Aries. 2,945,841.

Sulfonation of polymers. J. Eichhorn and J. M. Steinmetz (to Dow). 2,945,842.

Pentachlorophenylthioacrylate polymers. A. Armen and R. E. Gentry, Jr. (to Dow). 2,945,843.

Chlorination of polyisocyanates. J. J. Tazuma (to Food Machinery). 2,945,875.

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Ion-exchange resins. G. B. Butler and R. L. Goette. 2,946,757.

Ion-exchange resins. H. Zenftman (to Imperial Chemical), 2,946,758.

Polyacrylonitrile. H. D. DeWitt and P. H. Hobson (to Chemstrand). 2,946,760.

Polyacrylonitrile. W. H. Schuller (to American Cyanamid). 2,946,761-2.

Perfluorocarbon polymers. M. I. Bro and B. W. Sandt (to Du Pont). 2,946,763.

Stabilized polymers. E. Roos, F. Lober, and J. Koerner (to Bayer). 2,946,765.

Polycarbonates. H. Schnell and G. Fritz (to Bayer). 2,946,766.

Polyisocyanates. H. Gassmann (to Ciba). 2,946,767.

Carbamic acid ester condensates. E. Klauke and O. Bayer (to Bayer). 2,946,768.

Linear polyesters. J. K. Rose and H. W. Schulz (to Union Carbide). 2,946,769.

Polyamides. D. G. H. Ballard, C. H. Bamford, W. E. Hanby, and F. J. Weymouth (to Courtaulds). 2,946,771.

Vinyl copolymers. W. E. Walles and W. F. Tousignant (to Dow). 2,946,772-3.

Ethylenic interpolymers. R. M. Christenson (to Pittsburgh Plate Glass). 2,946,774.

Petroleum resins. A. D. deVries and F. J. Buchmann (to Esso). 2,946,775.

Ethylenic polymers. G. Scott and L. Seed (to Imperial Chemical). 2,946,776.

Polyolefins. T. S. Mertes (to Sun). 2,946,777.

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Extruders. C. F. Varn (to U. S. Rubber). 2,947,030.

Extruded tubing. C. W. Taylor Jr. (to Goodyear). 2,947,032.

Poly-α-chloroacrylates. H. D. Anspon (to General Aniline). 2,947,036.

Epoxide compositions. H. G. Cooke Jr. and J. E. Masters (to Devoe & Raynolds), 2,947,771.—**End**

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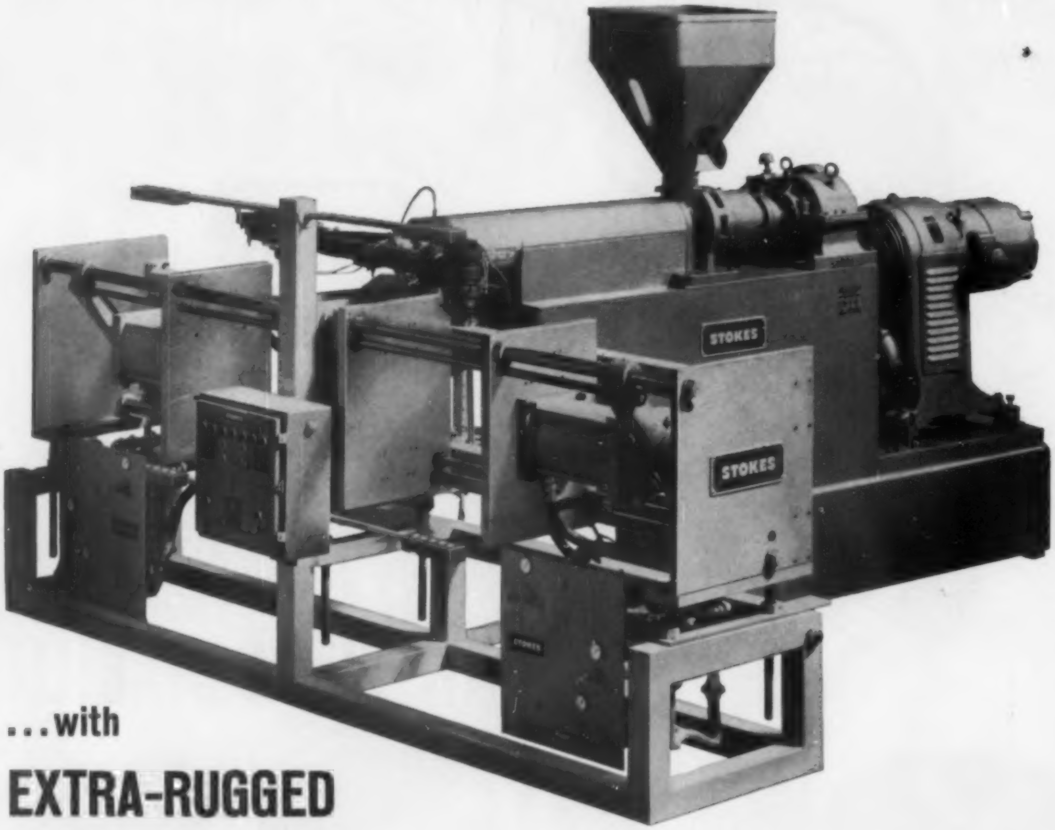

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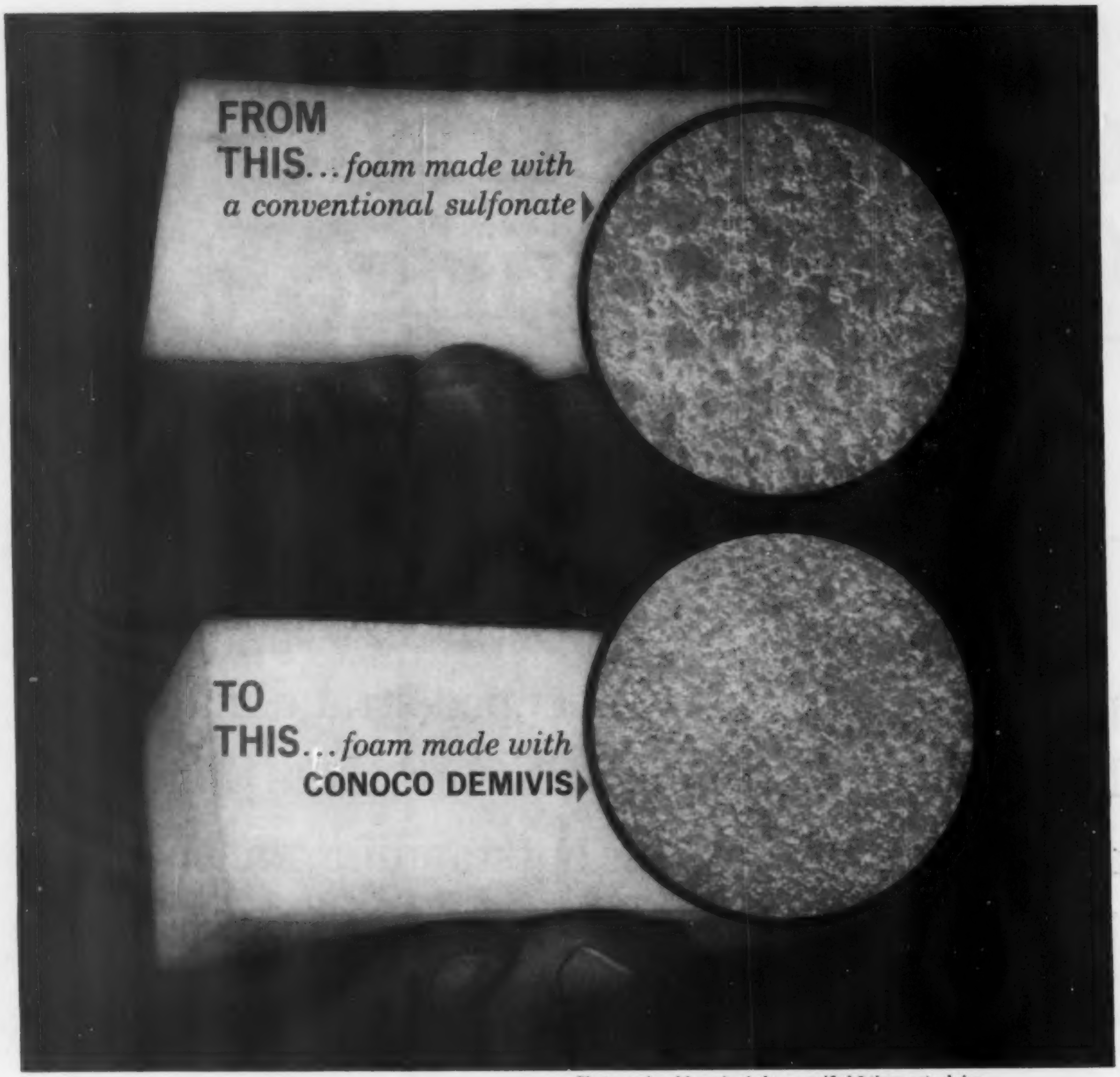

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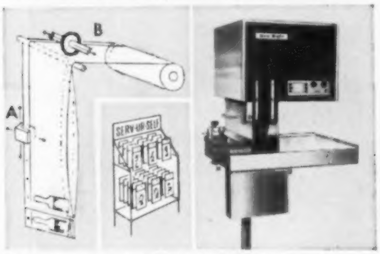
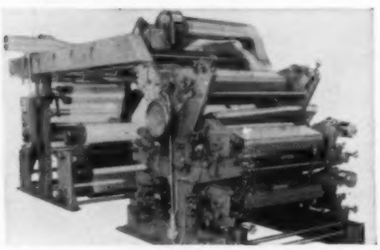


(Photo courtesy See-Safe Machine Co.)

A compact, single-drum flexographic press, designed to meet the packaging industry's demands for close register color printing on narrow web widths of polyethylene, has recently been introduced. Reportedly, it is useful for shorter runs, incorporates principal features of larger flexographic presses. Cost is said to be comparable to that of many stack-type presses.

Standard equipment includes a 30" diameter single-impression cylinder with four color stations; new positive-locking device for color and plate cylinder frames. This device eliminates vibration, assures accurate adjustment and printing quality.



(Photo courtesy Hudson Sharp Machine Co.)

Polyethylene handles on 25-lb. multiwall bags of granulated salt are being received favorably by consumers, according to a recent announcement. Injection-molded, the sturdy handles are simply sewn under the top tape during the ending operation. Bags need no special handling, as carriers lie back flat during filling, stacking, palletizing and shipping.

U.S.I.-International Constructing Offices and Laboratory in Baar, Switzerland

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A new customer service laboratory and office building is currently being constructed at Sihlbruggstrasse, Baar, Switzerland, by U. S. Industrial Chemicals Company-International—officially incorporated October, 1959, as Sales and Development Company of National Distillers and Chemical Corporation (International) S.A. Temporary headquarters are at Kirchenstrasse 13, Zug, Switzerland. The new building in Baar, Canton of Zug, is scheduled to be ready for occupancy about July, 1961.

A model of the new laboratory and office being built by U.S.I.-International in Baar. The laboratory will be used to demonstrate best techniques for processing polyethylene.

Serves PETROTHENE Customers Abroad

The new facility will support the efforts of U.S.I.-International's representatives, through whom sales of PETROTHENE polyethylene resins will continue to be made. It will help them provide their customers with the close technical assistance which the polyethylene market demands. Experienced personnel will conduct research and evaluation studies to help improve products and develop new consumer markets. The United Kingdom, as well as European countries, will be served.

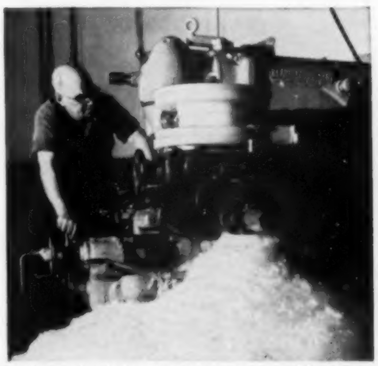
Well-Equipped Laboratory

The laboratory will be fully equipped with processing and test equipment designed to meet European standards and operating conditions. It will be used to demonstrate the best techniques for processing polyethylene into finished articles.

Polyethylene Used for Insulators in Nuclear Weapons Research

Two large polyethlene insulators, 18½ inches in diameter, have been made for use with a unique electrical switch in the discharge of heavy current loads from large condenser banks. Insulators and switch are reported to be part of research equipment used by nuclear physicists in the simulation and study of various aspects of nuclear weapons systems.

Polyethylene was chosen for its good insulating qualities, it is reported. Each insulator is said to be capable of withstanding voltages in the neighborhood of 100 kilovolts. The insulators were carefully milled to ensure design compatibility with the special two-million-ampere switch.



Milling polyethylene insulator for use with unique electrical switch in nuclear weapons research. (Photo courtesy Boeing Airplane Co.)

How to Build a Boat Shelter

To protect your boat against winter winds and snow, store it under polyethylene film. Lightweight, easy to handle, and inexpensive, it can be supported on a framework that's lighter and less expensive than the kind required by canvas coverings, according to the Canadian owner of a 37 ft. cruiser. He recommends building framework of bolted 2" x 2" lumber around the craft, covering it with 4 mil. black polyethylene, leaving a little slack. He makes vents in the roof, allows two feet between cover and ground.

U.S.I. Names New Vice-President

Paul J. La Marche has been made Vice-President of Production for U.S. Industrial Chemicals Co., Division of National Distillers and Chemical Corporation, it was announced by Robert E. Hulse, division General Manager and Executive Vice-President of the corporation.

Mr. La Marche joined the U.S.I. organization in 1949. Shortly afterward he became Manager of Sodium Sales. From 1951 to 1958 he was manager of the company's Ashtabula, Ohio, plants. He became Director of Production in October, 1958. Mr. La Marche is a graduate of Case Institute of Technology.

U.S.I. POLYETHYLENE PROCESSING TIPS

Series V, No. 6

ANNEALING CHAMBER IMPROVES OPTICAL PROPERTIES OF POLYETHYLENE FILM

Clarity and gloss of blown polyethylene film are substantially improved by enclosing the blown tubing with an annealing chamber, or "chimney", located between the extruder die and air ring. (See schematic below.) The new technique has little significant effect on the strength characteristics of the film. It does, however, require closer control to maintain bubble stability.

The chimney, a development of U.S.I.'s Polymer Service Laboratory, can be made of inexpensive materials such as cardboard, glass or insulated metal. It can be constructed in two sections or hinged, to eliminate threading the "bubble" through the chamber.

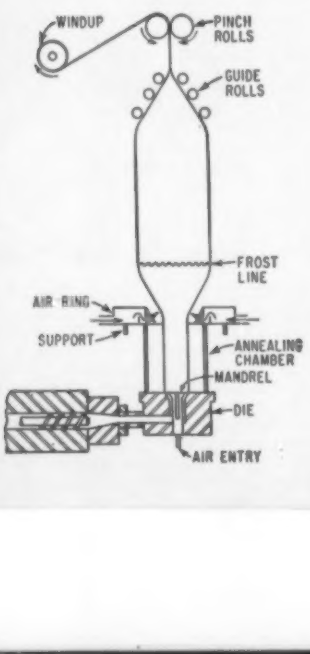
Although chamber diameter is not critical, best results are obtained with a chamber diameter 2" to 3" larger than the die diameter.

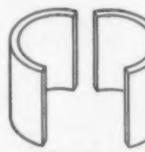
Importance of Retention Time

The degree of improvement in optical properties depends on retention time – the time it takes extruded film to travel from die lips to top of the chamber. This is a function of haul-off speed and chimney height.

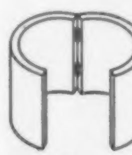
A retention time of 2 seconds gives maximum optical improvement but requires a chamber height of 30" at haul-off speeds of 75 ft/min. This is not feasible from a production standpoint as serious blocking of warm film occurs and gauge is difficult to control.

With respect to production, a retention time of one second seems optimum. This gives significant optical improvement at more realistic chamber heights – 10"-14" – and haul-off rates – 50-70 ft/min.





Two-section



Hinged

Effect on Film Properties

Test results given in the accompanying table show that the annealing chamber improves the optical properties of film made from some polyethylene resins more than others. In both transmittance and gloss, low-density resins are improved more than higher-density resins; and higher-melt-index resins more than lower-melt-index resins.

An increase in blocking and reduction in slip may occur in some cases due to less time available for cooling. This can usually be corrected by increasing the distance between the die and the nip rolls, or by use of anti-block agents and higher slip formulations.

Technical Help and Data Available

U.S.I. engineers are continuing work on the annealing chamber study. They will be glad to consider your particular operation and help in adapting the method to your needs. You are also invited to write for a new paper describing the annealing chamber in greater detail. Address Technical Literature Department, U.S. Industrial Chemicals Co., 99 Park Ave., New York 16, N. Y.

How Annealing Affects Optical and Strength Properties of Film from PETROTHENE® Polyethylene Resins

PETROTHENE Resin	239-27 (5/MI; 0.929 density)		205 (3/MI; 0.924 density)		200-28 (3/MI; 0.916 density)		201 (5/MI; 0.916 density)	
Retention Time, Sec.	0	1	0	1	0	1	0	1
Haze, %	7.9	7.6	7.9	6.8	10.5	6.8	9.5	5.1
Gloss, %	10.2	11.8	10.9	12.3	7.5	9.3	6.9	10.4
Transmittance, %	68	72	54	61	38	57	39	70
Impact Strength Sand Bag, ft.	1	1.5	1	4	6	7.5	>9	>9
Dart Drop, g.	215	80	–	–	175	85	280	255
Elmen. Tear M.D.	175	140	165	60	65	40	60	45
T.D.	170	105	145	100	75	75	45	65

U.S.I. INDUSTRIAL CHEMICALS CO.
Division of National Distillers and Chemical Corp.
99 Park Ave., New York 16, N. Y.
Branches in principal cities

Cast 1.25 mil polyethylene film from regular production run using PETROTHENE 218 resin.

DO YOUR CUSTOMERS . . . AND YOURSELF . . . A SERVICE
SHOW THEM THIS CLARITY AND GLOSS

It's cast polyethylene film made from U.S.I.'s new PETROTHENE® 218 resin – ideal for overwrap for bakery products, soft goods, paper products; ideal to process.

With U.S.I.'s new resin for cast film extrusion you get clarity, gloss, and freedom from haze that no other overwrap can surpass.

On the shelf, products overwrapped with cast film from PETROTHENE 218 have a sales-spurring sparkle. And when a shopper reaches, she's completely sold – the film's "soft feel" imparts a feeling of warmth and freshness to bakery products . . . a feeling of softness to clothing that "hard finish" overwraps can't suggest.

For your customers, this superior film means more sales, fewer returns, greater economy. Strong and resistant to moisture and grease, cast polyethylene film also has high stiffness; this makes it easy to handle on overwrap equipment designed or modified to handle polyethylene film. It's easy to print, easy to heat seal. And cast polyethylene gives the packager all the economy of polyethylene film – the least expensive transparent wrap on the market.

In your plant, PETROTHENE 218 (density, 0.933; melt index, 3.0) makes the grade too. It has excellent melt flow and hot-melt extensibility properties which permit high haul-off rates (>200 ft./min.) and relatively thin-gauge films (0.5 mil). It has been treated for printability in line with the extrusion process at rates exceeding 150 ft./min. At moderate treat levels, ink adhesion is excellent.

PETROTHENE 218 is available in three formulations of varying slip level: PETROTHENE 218, unmodified no slip; 218-26 – medium-low slip; 218-27 – medium slip.

For more information or for technical assistance in providing your customers with all the advantages of overwraps made from PETROTHENE 218, contact U.S.I.

U.S.INDUSTRIAL CHEMICALS CO.
Division of National Distillers and Chemical Corp.
99 Park Ave., New York 16, N. Y.
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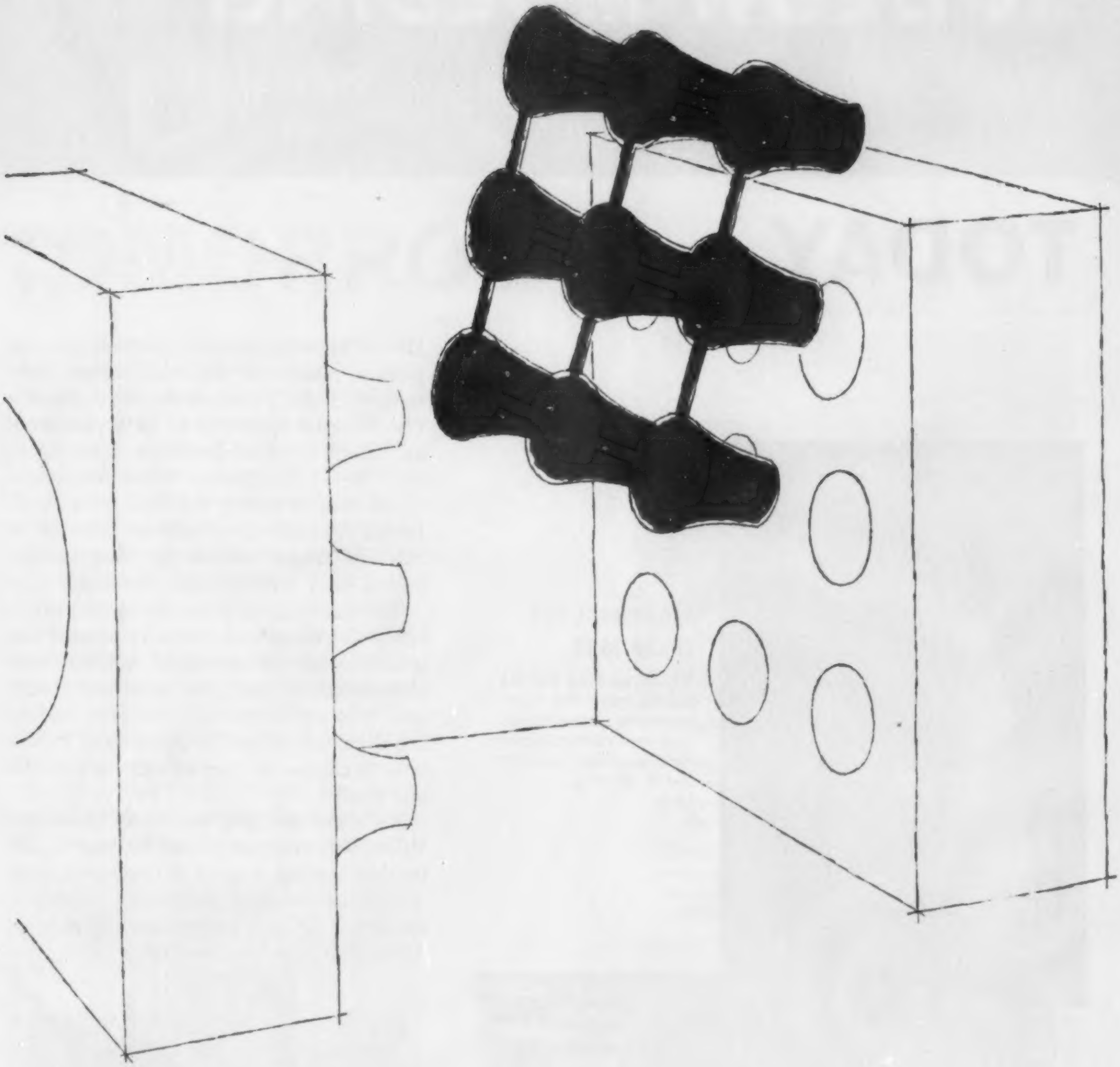


IN BLOW-MOLDING

Hi-fax® Sets the Standard Other Materials Strive to Match

TODAY

Hi-fax, high-density polyethylene, was the pioneer plastic in thin-wall, blown containers. Hi-fax set the standard . . . was the first material approved by both producers and users of plastic containers for light-duty liquid detergents. While other materials seek to match the Hi-fax standard, Hi-fax remains universally in demand in this first major market for blow-molded high-density polyethylene products.

The same physical and processing properties which enabled Hi-fax to pioneer the breakthrough in detergent bottles have proved equally useful in household chemical, drug and cosmetic containers, and in the development and production of industrial packages of increasingly larger size and scope.

As blow-molding horizons broaden, Hi-fax will continue to lead the way . . . in product testing, market development, and continuous research designed to improve the properties and performance of today's finest blow-molding material.

TAILORMADE FOR TOUGH JOBS

These nesting Hi-fax bottles carry the water supply for a housetrailer; they were custom-blown to fit available space in trailer interior.

BIG FAVORITE WITH BIG BRAND NAMES

Hi-fax blown containers are now used by all of the major manufacturers of light-duty liquid detergents.

FOUR VARIATIONS ON A THEME

Avon uses the same Hi-fax container to package both liquid and dry products in its new line of children's cosmetics.

HI-FAX LEADS THE WAY

The larger the part—the greater the need for Hi-fax

TOMORROW

Growing faster than any other sector of the plastics industry, blow-molding now reaches out into many new markets: industrial packaging, sporting goods, toys, furniture, lighting, and automotive and marine parts. Parts grow larger as improved equipment and processing techniques keep pace with new demands. And still leading the way is Hi-fax, for the larger the part, the greater the need for Hi-fax in terms of superior physical properties and ease of processing.

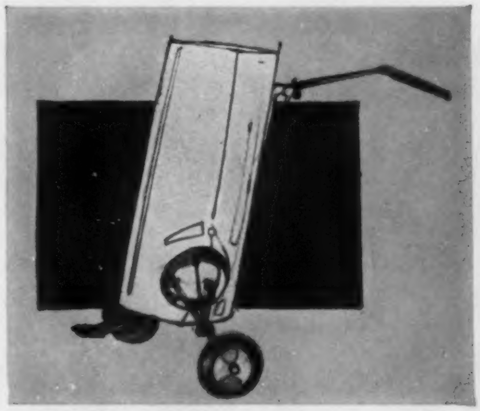
Hi-fax leads the way, too, in new market developments. Hercules blow-molding experts are ready to help you with design and product planning, in order that you may achieve maximum economies in material and production costs.

Here's a preview of some of the brand new product ideas now possible with Hi-fax and blow-molding:

INDUSTRIAL PACKAGING:

Double-wall bottle solves the packaging problem which arises when two separate ingredients in a product must be shipped separately for mixing immediately prior to use. Blow-molded with Hi-fax, this combination bottle would have the all-important stress-crack resistance so necessary when corrosive products are involved.

ORIGINAL DESIGNS BY SUNDBERG-FERAR, DETROIT, MICH.



SPORTING GOODS:

This ingenious design for a golf cart combines bag and wheeled-carrier in a single, compact, lightweight unit which can be readily blow-molded with Hi-fax.

Wheels (and tires, if desired) could be blown parts, too. Complete unit would be highly functional, less tiring to use, weather-resistant, and significantly lower in cost.

TOYS:

Tough, but handsome, too, blow-molded Hi-fax has just what it takes for the design of such modern-styled outdoor toys as this. Both body and wheels could be blown with Hi-fax, resulting in a unit that would be less than half the weight of a metal counterpart, with a finish that would not dent, chip off, rust or corrode.

HERCULES

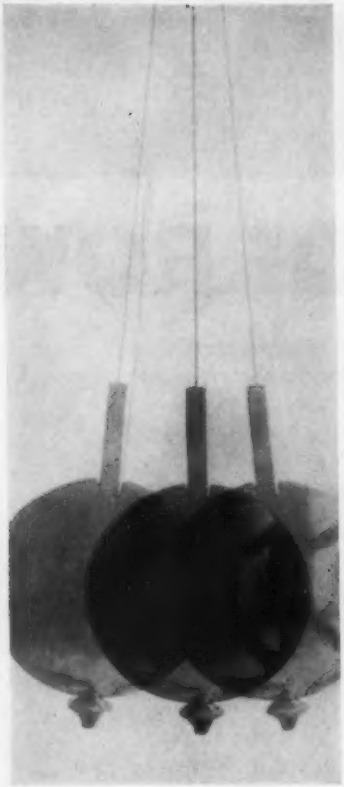
HERCULES POWDER COMPANY
INCORPORATED
Hercules Tower, 910 Market Street, Wilmington 99, Delaware

THREE NEW MATERIALS FOR THE PLASTIC INDUSTRY

HI-FAX® HIGH-DENSITY POLYETHYLENE • PRO-FAX® POLYPROPYLENE • PENTON® CHLORINATED POLYETHER

CP60-18

Protection against the March



of Time

When storing rubber, plastics or oils and fats for an extended period of time, an effective Anti Oxidant is an excellent protection against losses.

Our Anti Oxidants in numerous tests have proved their superiority in these applications.

ADVASTAB 401 ADVASTAB 403
ADVASTAB 405 ADVASTAB 406
Advance Triphenylphosphite
Advance Tridecylphosphite
Advance Phenyldidecylphosphite

Our technical experts are always glad to assist you in selecting the product best suited to your requirements.

DEUTSCHE ADVANCE PRODUKTION GMBH
Marienberg über Bensheim, West-Germany


pigments fr


rom gdc

pigments from gdc

add sales appeal to paints, plastics, inks, rubber

PIGMENTS*	PAINTS	PLASTICS	INK	RUBBER
Azo Pigments				
Hansa® Yellows	■		■	
Benzidine Yellows				
Pigment Yellow			■	■
Permagen® Yellow	■	■	■	■
Permanent Yellow		■	■	■
Benzidine Orange				
Permagen Orange		■	■	■
Dianisidine Orange				
Permagen Orange		■	■	■
Permanent Red	■		■	
BON Reds				
Permagen Red		■	■	■
Dioxazine				
Permanent Violet	■	■	■	■
Naphthols				
Helio® Red		■	■	
Naphthol Red		■	■	
Permanent Red	■	■	■	■
Permanent Carmine	■	■	■	■
Parachlor Red				
Pigment Red	■		■	
Phthalocyanines				
Heliogen® Blue	■	■	■	■
Heliogen Green	■	■	■	■
Heliogen Viridine	■	■	■	■
Pigment Scarlet				
Permagen Scarlet		■	■	
Pyrazolone Reds		■	■	■
Vats				
Anthragen® Colors	■	■	■	■
Helio Fast Colors	■	■	■	■

* A partial listing of pigments from GDC. For further information contact your local GDC Technical Service Representative.

FROM RESEARCH TO REALITY

GENERAL DYESTUFF COMPANY

A SALES DIVISION OF

GENERAL ANILINE & FILM CORPORATION

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CHARLOTTE • CHATTANOOGA • CHICAGO • LOS ANGELES • NEW YORK • PHILADELPHIA • PORTLAND, ORE.
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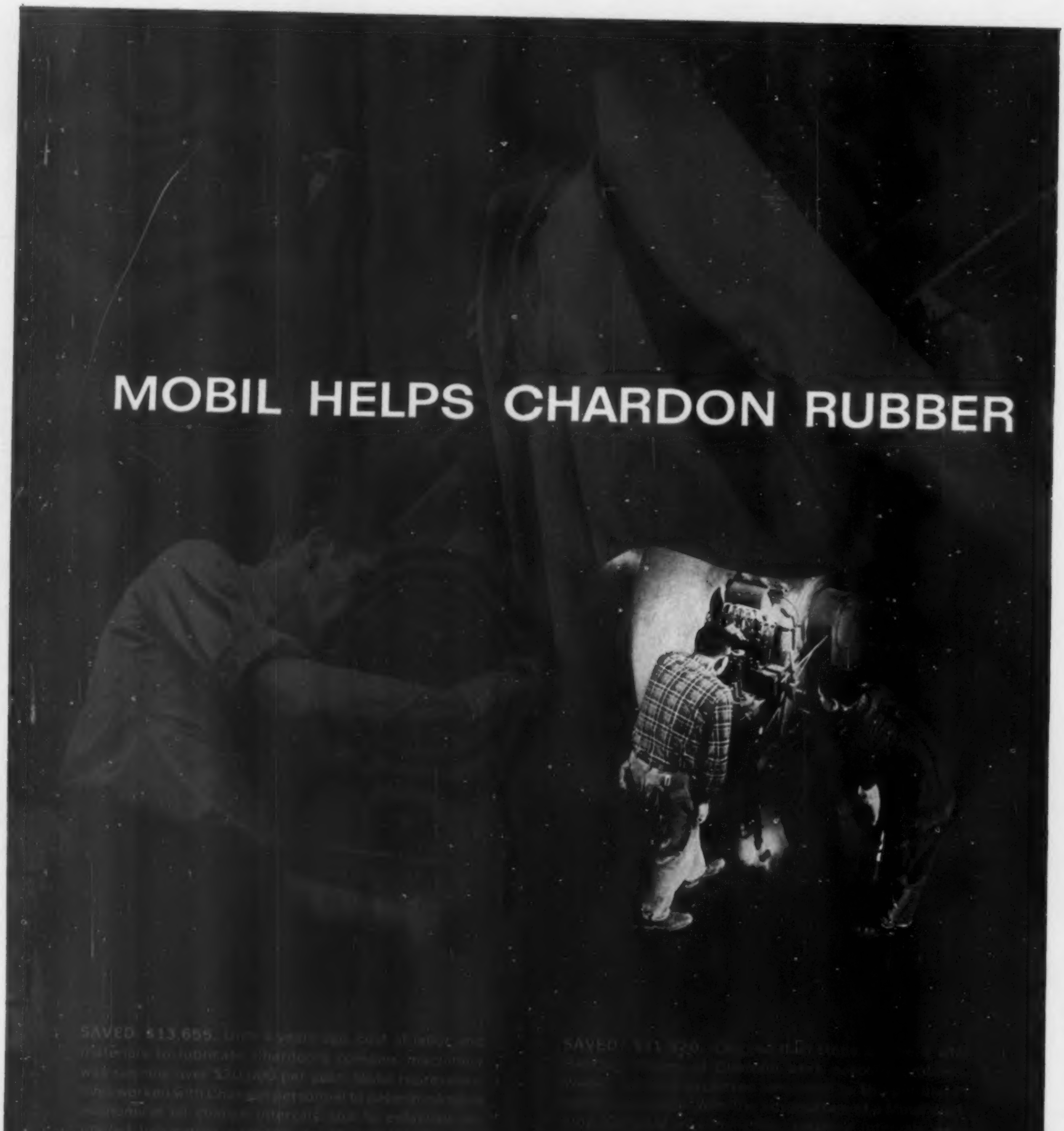

MOBIL HELPS CHARDON RUBBER
SAVED $13,655.

Oil life extended, lubrication costs slashed, maintenance techniques improved, equipment downtime reduced—average annual savings over four-year period: $6,928.

The Chardon Rubber Company produces a wide variety of specialty items for industry. These items include thousands of precision-molded and -extruded rubber and plastic pieces of various shapes.

Quality control and accuracy are of prime importance at Chardon. And to maintain high level production and equipment performance, Chardon relies on Mobil lubricants and Mobil technical assistance. By suggesting oil re-use, by extending lubricant life, by recommending correct products and improved application techniques, Mobil has helped Chardon *save twice as much in maintenance costs as they have spent on Mobil Products.*

Interested in how Mobil may benefit you? Call your Mobil Representative. Or write: Mobil Oil Company, 150 East 42nd Street, New York 17, N. Y.

SHAPE $27,713 SAVINGS!

SAVED: $1,600. With excessive carbon build-up causing faulty valve seating and an explosion hazard in three air compressors at Chardon, these compressors had to be opened up for valve cleaning or replacement an average of 10 times a year collectively. Mobil recommended correct cylinder lubricant and proper feed rates. Result: compressors have run over 4 years without overhaul.

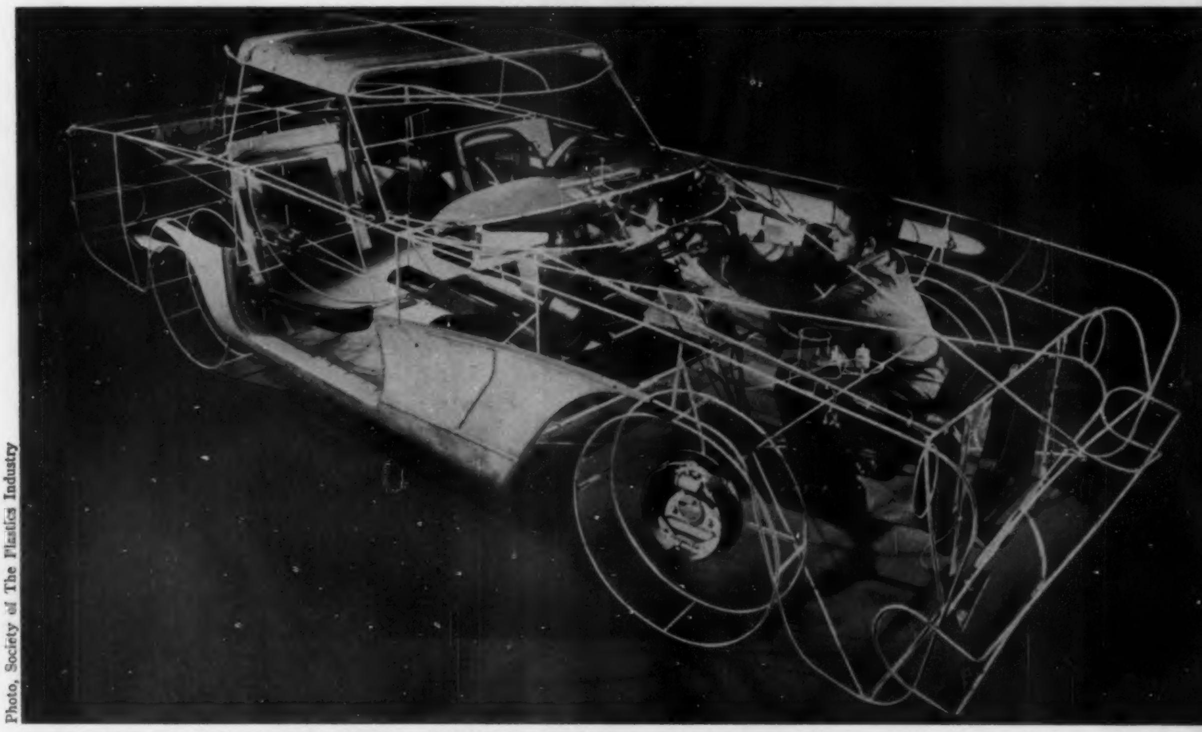
SAVED: $938. Chardon Rubber encountered these problems in 42 molding presses: damaged packings, gasket failures, leaking valves and rusted rams and cylinder walls. By changing the hydraulic fluid formulation, Mobil has reduced these problems materially—saved Chardon $938 in 18 months.

Mobil CORRECT LUBRICATION


How specifying AMOCO Oxo Alcohol results in better quality phthalate plasticizers
If you make DDP, DDA, DIOA and DIOP you can produce lighter colored, more stable plasticizers with AMOCO Oxo Alcohol. The extremely low carbonyl content, excellent esterification color and storage stability of AMOCO Oxo Alcohols are the reasons. The mechanical and electrical properties of vinyls compounded with DDP made from AMOCO Decyl Alcohol are particularly outstanding.
As an esterifier you get an important plus with AMOCO Oxo Alcohols in addition to better quality finished product. You get improved processing. Crude esters require less bleaching to meet color specifications. Less trouble is encountered with the re-use of unreacted alcohol.
Your inquiry about AMOCO Oxo Alcohol will receive immediate attention.
AMOCO CHEMICALS
AMOCO CHEMICALS CORPORATION
910 South Michigan Avenue
Chicago 80, Illinois

November 1960, Volume 38, Number 3

MODERN PLASTICS



Photo, Society of The Plastics Industry

MORE THAN 300 COMMERCIAL APPLICATIONS OF PLASTICS in the 1961 auto—from instrument clusters to tiny bushings—are here being put in place in the mock-up auto that was the heart of the SPI plastics display at the recent Automobile Exposition in Detroit.

1961 AUTOS: proving ground for plastics

End-users can learn much from a study of the new applications of plastics which Detroit designers have incorporated in more than 300 components of their recently unveiled models

Visitors to the National Automobile Show which opened in Detroit, Mich. last month saw a precedent-breaking exhibit—a display sponsored by The Society of the Plastics Industry that focused attention on the automotive industry's role as a major consumer of plastics. The theme: plastics are the automotive industry's most versatile engineering material. The evidence: better than 300 components made of plastics that appear in the 1961 passenger and commercial vehicles, representing the largest volume consumption of plastics ever recorded by the industry. Officially, the estimate is around 22 lb. per auto (not counting the volume that goes into upholstery, floor mats, paints, and laminated safety glass); unofficially, estimates have

NEW CONCEPT IN RP AUTO APPLICATIONS: a molded phenolic-glass headliner more versatile, tougher, and easier and more economical to install than sewn fabric liners. Despite its size, part weighs only five pounds.

Photo, Owens-Corning Fiberglas

gone up as high as 30 pounds. Whatever the figure, a 6-million-unit year means a market for around 150 million lb. of plastics.

And it's only the beginning. Injection molded polypropylene foot pedals at 1/5 lb. apiece have yet to make their impact on the automotive scene; injection molded instrument clusters of acrylonitrile-butadiene-styrene (ABS) or Delrin acetal weighing some 2 lb. each are only now starting to make their move; high-density polyethylene glove boxes that go as high as 1½ to 2 lb. apiece are still under evaluation by several manufacturers; and the same could probably be said for most of the other new plastics applications described below. With this as a background, experts are now talking about a possible ½ billion lb. consumption figure by 1970. And this is still on the conservative side!

What really distinguishes the 1961 models from previous years, however, is the emphasis which Detroit engineers have placed on new plastics materials and new processing techniques. After obvious months of research and field testing, these engineers have come up with a record number of unique commercial adaptations of plastics—and, as always, they involve either a functional improvement, a substantial cost savings, or a sizable weight reduction. All plastics end-users can learn much from the whys and wherefores of plastics applications in the 1961 auto.

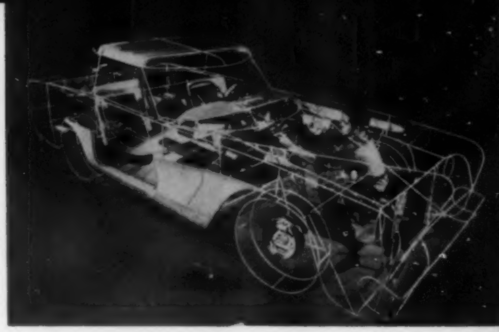
Why plastics?

Let's start with the "why?"

One of the best answers to this question is the simple statistic cited by the SPI that *the 22 lb. of plastic going into 1961 cars replaces approximately 150 lb. of steel and other metals.* That's an 85% reduction in weight! And think what that means to a manufacturer trying his hardest to eliminate enough dead weight to meet the competitive modern emphasis on smaller cars, reduced operating costs, and better mileage.

Functionally, automotive engineers feel that the plastic part can be as good as—or more likely, better than—its competitive metal part. And cost-wise, plastics win hands down! Although their initial price per pound may be higher than metal's, when one takes into account the lower specific gravity of plastics (more parts per pound) as well as the economies that are inherent in injection molding or otherwise proc- (To page 88)

Plastics applications at the 1961 Auto Show



Below are 150 reasons why 1961 autos have chalked up record consumption of plastics; and this is only one-half the total that will be put to work next year

ABS
Instrument cluster
Dome light bezel
Heater—control switch, defroster and heater ducts
Air grilles, valves, vanes
Radio grille and buttons
Arm rest
Steering column bezel
Crash pads
Body wiring harness
Air conditioner housing
Garnish moldings
Printed circuit back can
Lock knobs and ferrules

Acetal
Steering linkage ball seats and bushings
Bushings
Parking brake and transmission cable pulleys
Tie rod bearing
Truck air hose coupling
Windshield washer pump control assembly
Carburetor dash pot cover
Instrument cluster
Turn signal control cable housing
Door handles
Window cranks and regulator

Acrylic
Speedometer dials
Instrument cluster facing
Indicator dial
Tail lights and lenses
Steering column gear selector bezel
Air conditioner front, grille, etc.
Horn buttons
Medallions

Acrylic, modified
Control cable & tube clamp
Instrument back panel
Arm rest
Garnish moldings
Dial faces

Cellulose Acetate Butyrate
Transmission buttons
Instrument cluster parts
Control knobs
Arm rest
Steering wheel

Fluorocarbon
Washers and bushings
Valve stem seal
Automatic choke bearings
Carburetor throttle shaft bearings
Power steering piston ring seals

Melamine-Glass
Electrical insulator

Nylon
Cutlet nut—windshield washer foot pump
Bushings and bearings
Brake cable liner
Gears for speedometer take-off, etc.
Vacuum check valve seat
Ball bearing retainers
Windshield washer "T" connections
Windshield washer valve body
Restrictor
Vacuum spark advance tubing
Carburetor cams and filters
Fuel filter housing
Oil slinger
Cable clips
Dome lamp lens and base
Coil form
Insulation for voltage regulator base
Horn ring insulator
Lamp socket
Mirror case back
Coat hooks
Electrical connectors
Window regulator rollers
Door striker wedge
Body wiring harness

Nylon coated paper
Armature slot lines

Phenolic
Distributor dust cover
Water pump impeller
Insulators for horn, etc.
Brake linings
Rotors
Distributor cap
Ball joints
Speedometer gear train
Light switch, drivers and drive sleeve
Printed circuit boards

Phenolic-Glass
Reverse clutch cone
Rear oil pump gear
Headliner

Phenolic, paper base
Light shield
Plate for windshield wiper motor brush holder
Washers for starter in solenoid battery stub
Insulator for generator regulator contact post
Electrical regulator base
Electrical terminal boards
Bushings for distributor
Gears

Polyester-Glass
Heater, defroster, air distributor housings, etc.
Air duct blower inlet
Body proper
Grilles and fenders
Instrument cluster housings
Tail light assembly

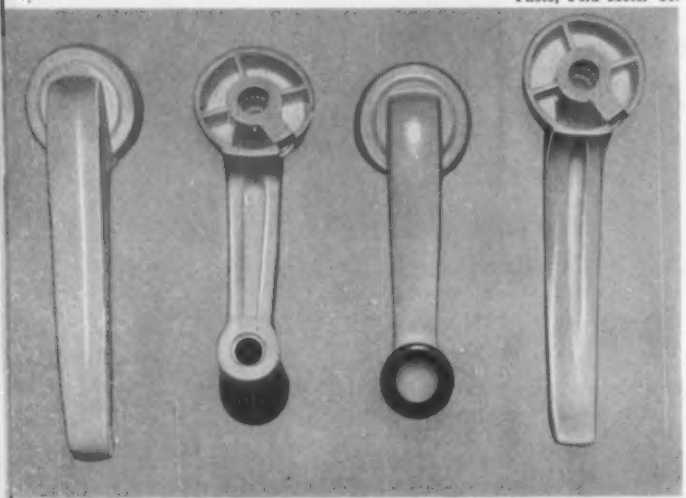
Polyethylene
Spring inner liner
Spring insert
Windshield washer reservoir
Carburetor air horn cover
Heater duct, double wall
Glove boxes
Cowl side trim panel
Pivot cover
Kick panel
Seat side shield
Spare tire cover
Plugs, grommets, gaskets, pads
Body wiring harness

Polypropylene
Windshield washer pump check valve assembly
Brake cylinder plugs
Dome lamp base
Rear shelf defrost nozzle
Air conditioner louvre
Radio speaker grille
Electrical connectors
Accelerator pedals
Trip clips
Knobs

Polystyrene
Fresh air inlet—housing and valve
Rain baffle adapter
Heater—housing, duct, air vent cover
Cold air inlet grille
Hot air deflector grille
Steering column cover plates
Battery cases

Vinyl
Battery tray drain tube
Connector assembly
Door handle escutcheon plates
Heater and body wiring harness
Package tray seals
Inside door handle escutcheons
Protective covers for screws
Plugs, grommets, gaskets, pads

Photo, Ford Motor Co.



BIG FIRST FOR PLASTICS: Ford's molded acetal handles and window cranks highlight plastic's entry into the design of automobile hardware. Stiffening ribs, mounting lugs and bosses are all molded into the plastics parts.

essing complex precision parts in one piece, the balance shifts strongly in favor of plastics.

In its preparation for the Auto Show exhibit, the SPI came up with the following comparative data: the finished price of an injection molded 5-cu.-in. part in plastics would range from a low of 9½¢ to a high of 47½¢; prices for metal parts after moderate finishing (simple reaming, tapping, drilling, etc.) would be between 40 and 48¢ for steel cold rolled alloy, aluminum, and zinc and up to 69¢ for yellow brass; if extensive finishing (e.g., complex machining on a jig set-up, polishing, plating, etc.) is necessary, the cost would climb to 57¢ for aluminum, 58½¢ for zinc, and 85¢ for yellow brass. An SPI spokesman has predicted that "continuation of the current growth rate of plastics in automobiles should result in annual savings of more than $100 million for the automotive industry by 1970."

And where plastics?

With so much going for plastics, it is small wonder that automotive engineers keep finding new applications for the material. On p. 87 are listed about 150 of the more than 300 plastics applications that showed up in one form or another at the Auto Show. In scope, it is certainly the most varied and exciting grouping plastics have ever enjoyed. Even more revealing are the concepts of plastics usage embodied in many of the applications. Described in detail below are those which automotive engineers feel are most significant for 1961.

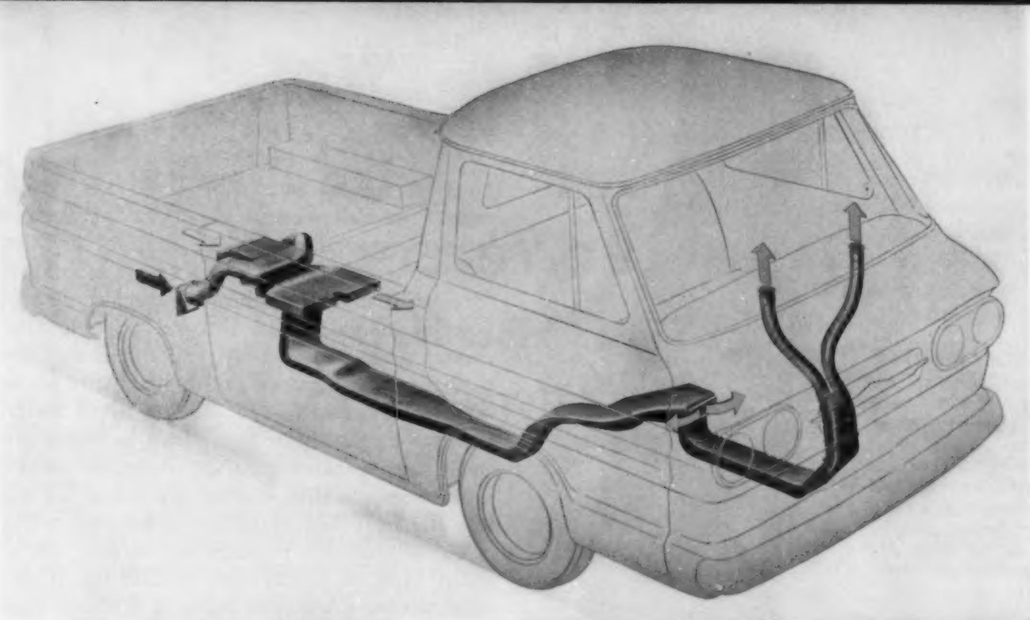
- Described as the "most revolutionary devel-

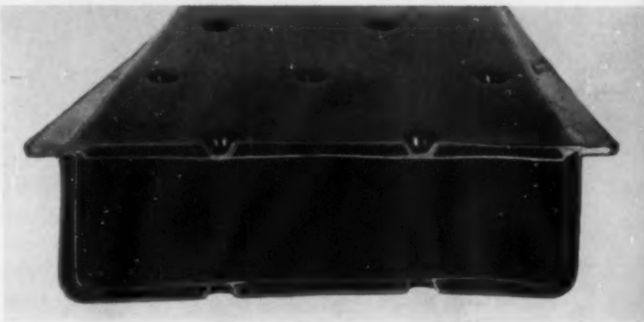
Photo, U. S. Rubber Co.

PLASTICS OUTMANEUVER DIE CAST ZINC functionally and cost wise in instrument cluster design. Model above was molded of acrylonitrile-butadiene-styrene for 1961 Buick. Printed circuit is bonded directly to the molded ABS backcan of cluster . . .

. . . model at right was molded of acetal for the 1961 Chrysler Valiant. Housing turned out to be seven pounds lighter than metal counterpart, easier to ship and handle, and more economical from the standpoint of assembly costs.

Photo, Chrysler Corp.





HIGH-DENSITY POLYETHYLENE HEATING DUCT: outstanding example of blow molding's versatility. Sections of ducting are blow molded in two halves, each half complete with double wall construction (see cross-section, right). Halves are then "heat welded" together to form finished duct. Walls are bonded together (or "dimpled") intermittently to improve strength and rigidity. Four sections, weighing a total of 7 lb. are joined together to make up the complete ducting system (shaded area, above). Vents are molded of polyester-glass premix.

Photo top, Chevrolet
Photo right, Woodall Industries

opment in automobile interiors since the first enclosed car was made," a phenolic-glass acoustical headliner for American Motor's 1961 Rambler Classic 6 and V-8 and the Ambassador V-8 becomes the first really serious contender to challenge the position of the sewn fabric ceiling liners—and the fabric liners go back to the 1900's! As developed by American Motors in conjunction with Johns-Manville (and as now produced both by Johns-Manville and Owens-Corning), the phenolic-glass liners are based on a unique processing concept. Here is how they are made:

The liner begins with a fluffy white blanket about 2½ to 3 in. thick made up of acoustical glass fibers. The blanket is laid in the female half of a gas-heated compression mold and a liquid phenolic resin is sprayed into it. Next, high-density polyethylene film, about 3-mils thick, is laid over the blanket; the film in turn is covered with a second layer of glass cloth dyed to the required color (eight colors are available). Heat and pressure are then applied to the layup, causing the phenolic resin to polymerize and cure while the PE film softens to function as an "adhesive layer" that bonds the glass blanket and the glass cloth together.

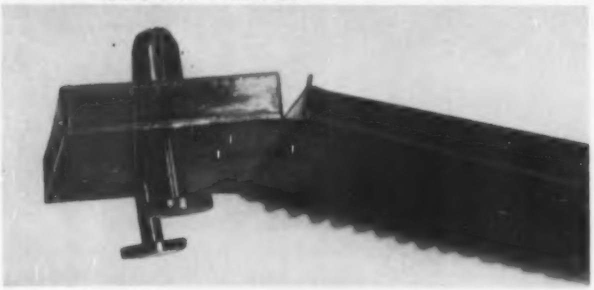
In its finished form, the liner offers several advantages. With an average thickness ranging from ½ to ⅝ in., tapering to ⅛ in. at the edges and center, the plastic acoustical ceiling panel weighs only about 5 lb. (and makes possible up to ¾ in. more head room). It is far superior to conventional fabric liners in its ability to dampen sound by muffling all noise and vibration; it will retain its shape longer than fabric liners, is easier to keep clean, and is both fireproof and waterproof. Although its initial cost is higher than the fabric liners, the labor savings involved in installing the plastic panel by sliding it into place from the front and mounting it in a matter of minutes with clips and moldings will *more than offset* the difference.

Industries other than automotive are already looking at it with interest. Busses, trucks, railway cars, aircraft, construction, and appliances have been named as possibilities for what may turn out to be an annual $100 million market.

• In a hard-fought fight with die-cast zinc, plastics have finally started to edge into the

NEW PLASTICS FRONTIER: a one-piece polypropylene accelerator pedal with molded-in integral hinge. Bottom (see right) shows stiffening ribs, and flexible hinge which joins pedal and mounting base. Slotted assembly pins (below) could be molded-in in the same shot for big costs savings.

Photos, Hercules Powder Co.



very logical area of instrument cluster design—probably the most important breakthrough for plastics this year. Here are the four models that are spearheading the drive in 1961: in the 1961 Plymouth Valiant, the cluster consists of a basic housing molded of Du Pont's Delrin acetal by Republic Corp.'s Consolidated Molded Products subsidiary and a clear acrylic front; for the 1961 Buick Special, AC Spark Plug Div. chose U. S. Rubber's Kralastic ABS for a three-part molding—bezel, hood, and case; and in the Chrysler Astra-dome cluster and in the Dodge Lancer, Marbon's Cycolac ABS got the nod.

All of the instrument cluster models mentioned above weigh about 2 lb.; competitive models in die-cast zinc weigh in at about 9 lb. —an 80% savings in weight. Against die-cast zinc, too, plastics can show some real economies. Plastic's lower specific gravity gives more parts per pound, molds are considerably less expensive than those for die casting, parts that formerly had to be fabricated separately can now be molded-in as integral parts of the cluster (e.g., screw holes and mounting lugs that permit dial faces and instruments to be mounted directly to the housing), and design features impossible to deep draw in metal are easily incorporated into the injection mold.

More specifically, Marbon Chemical Co. offers the following hypothetical figures: a finished 2-lb. cluster in ABS would cost out at about $1.50 with vacuum metallizing, if desired, adding a few cents extra; a 10-lb. die-cast zinc cluster, in contrast, is costed out at about $1.60 before expensive finishing and trimming and before chrome plating.

In the Kralastic cluster, a unique cost savings advantage is inherent in the use of the back half of the cluster as a printed circuit base. The copper which forms the pattern is die cut out of a flat sheet and then bonded directly to the ABS. The printed circuit makes possible plug-in wiring for the entire cluster and eliminates the clutter of wiring usually required for instrument panels. It also eliminates the need for a production worker to place about six wires in position during the assembly process.

• It has taken a linear PE heating duct produced by Woodall Industries, Detroit, Mich., for Chevrolet's 1961 Corvair Greenbrier sports wagon and Corvan delivery unit to show the industry what blow molding can accomplish.

In a revolutionary departure from the traditional shape expected of a blow molded product (e.g., the windshield washer reservoir jar going into so many 1961 models), Woodall has used a blowing technique to fabricate a double-walled half-section of ducting (in essence, a hollow convex shape with the two walls relatively close together) (see photo p. 89). Two blown half-sections are then joined together along their edges by a special "heat-welding" technique. At the same time, the walls of each half section are bonded together (or "dimpled") intermittently to provide increased strength and rigidity. The completed sections are then joined together and to complete the plastics picture, the ends of the ducting through which the warm air is vented are molded of a polyester-glass premix. Total weight of the four PE parts is 7 lb.; total weight of the premix parts is 6 pounds.

The result: a light weight, **(To page 190)**

AUSTRALIAN PLASTICS INDUSTRY CONFERENCE

Attesting to the growth of the plastics industry in Australia, the recent Third Australian Plastics Convention and Exhibition at the Chevron-Hilton Hotel in Sydney drew a record turnout. More than 650 delegates from all Australian states and overseas attended, and 47 Australian companies representing a broad range of plastics interests used a record 4000 sq. ft. of space to display their products.

In a singular tribute to the American plastics industry, the guest of honor of the PIA (Plastics Institute of Australia), sponsors of the show, was Charles A. Breskin, Chairman of the Board of Breskin Publications Inc., and founder of MODERN PLASTICS and MODERN PACKAGING magazines. Mr. Breskin was chosen to deliver the John W. Derham Memorial Lecture, established in honor of one of Australia's outstanding plastics pioneers. His paper on "World Wide Growth Trends in Plastics Applications" was delivered to an audience of 1000 people on September 19 after the convention had been officially opened by the Governor of the New South Wales, Lt. Gen. Sir Eric Woodward, K.C.M.G., C.B, C.BE., D.S.O. For his contribution to the proceedings, Mr. Breskin received the coveted John W. Derham Lecture medal. A surprise honor was the presentation to Mr. Breskin by Mr. Charles Rothauser, Institute President, of a life membership in the PIA—the seventh such honor to be awarded. At the end of the 3-day conference which was devoted to plastics application developments in Australia, Mr. Breskin traveled to the University of Melbourne where, on October 3, he was guest speaker at a joint meeting of the National Packaging Association of Australia, the Association of National Advertisers, and the Association of Advertising Agencies. On October 4, he was guest speaker at a meeting of the PIA in Melbourne. And with traditional Australian good humor, Mr. P. W. Gill, Pres. of the Victorian section of PIA, ended this meeting by conferring on Mr. Breskin the honorary title of B.G.B.—"Bloody Good Bloke."

On October 6 Mr. Breskin was guest of honor at the National Plastics Week dinner, where he presented the F. H. Edwards' Plastics Industry Laurels to the winning companies. The Laurels were established by Mr. Edwards, a prominent member of the Victorian Plastics Industry, to provide an incentive to Australian molders and fabricators to continually improve quality. A full report on the winning entries will appear in the next issue of MODERN PLASTICS.

Mr. Breskin also addressed sections of the Plastics Institute of Australia in Brisbane and Adelaide, in addition to giving numerous television, radio, and newspaper interviews on both plastics and packaging.—**End**

ABOVE: The John W. Derham Memorial Lecture medal which was awarded to Charles A. Breskin, right, founder of MODERN PLASTICS magazine. Mr. Breskin delivered the annual lecture named in honor of the late Australian plastics pioneer in Sydney on September 19.

Plastics in the product revolution:

Molded phenolic iron handles are outstanding examples of plastic molding at its best, and—like the tail wagging the dog—their use has revolutionized the styling and functional efficiency of a basic home appliance

EARLY TWO-PIECE phenolic handle for iron produced by a forerunner of Sunbeam Corp. Plastic, with wood-flour filler used for low heat transmission, replaced wood; however, the basic wooden design was retained.

Molded plastic handles—practically all of them molded of phenolic by the transfer process—have revolutionized the appearance and performance capabilities of the electric iron.

Today, one must visit a museum to find an iron with a wooden handle. Yet the early stages of transition from wooden to plastic handles, beginning more than three decades ago, were often difficult. Years of pioneering effort by molders and material suppliers were required to bring electric iron handles to their present state of development. Today, with their intricate coring, thumb rests, heel rests, water inlets, switch and control mountings, and other features, they are outstanding examples of plastic molding at its best.

Electric iron manufacturers now use highly-

Photos, Union Carbide Plastics Co.

DESIGN CHANGES made possible by switch from wood to plastics, combined with improving techniques, are evident in these handles, which were produced between 1920 and 1930.

IRON HANDLES

THE COVER: The modern Presto iron is as different from its 1920 cast metal, self-heating (by kerosene) counterpart as night is from day. Two things account for the difference: electricity and modern molding technique, which makes possible the high-style functional phenolic handle, control knobs, water chamber, and heat shield. Antique iron is from the collection of Charles H. Rutledge, Du Pont Co.

styled molded phenolic handles for everything from compact, light-weight travel irons to ultra-modern steam-and-dry irons which at the touch of a button will even spray a stream of water to eliminate stubborn cloth wrinkles. In 1959, approximately 6,330,000 electric irons of all types were produced in the U. S. During the same year, total volume of phenolic material used in electric iron handles is estimated by trade sources at approximately 3.3 million pounds of resin.

Plastic: style plus function

Plastic handles brought a new standard of appearance and convenience to this most basic of all home appliances. They eliminated the costly, tedious process of shaping and finishing wooden handles, simplifying manufacturing operations by replacing a number of assembled components with one highly functional part. Styled to fit the hand comfortably, they were not handicapped by the design limitations of wooden handles, most of which were turned on lathes and mounted between metal supports. Along with permanent, built-in color, plastic handles brought desirable thermal and electrical insulating properties difficult to obtain in other materials.

Beginning with early versions which were largely a replica of the cylindrical wooden handles that preceded them, plastic iron handles have grown increasingly larger, more attractively styled, and more functional.

What appears to be the ultimate concept of the plastic iron handle—at least up to the time of writing—is that used on the new Presto steam and dry iron recently announced by Presto Industries Inc., Eau Claire, Wis. On this iron (see front cover illustration reproduced above), the one-piece molded phenolic combination handle and cover forms practically the entire visible surface of the appliance, except for the aluminum sole plate. Thanks to the

HANDLE PLUS—this was next logical extension of plastic properties. In this early model of a Proctor Never-Lift iron, lever mechanism was developed with wooden-handled prototype, but a molded plastic component was designed to serve as handle and to hide unsightly mechanism on production models.

fully extended treatment of the cover and handle, styled by Mel Boldt & Associates, Chicago, Ill. industrial design firm, there are no exposed metal surfaces to waste heat or pose a burn problem. This handle, weighing slightly less than 1½ lb., also produces a cooler operating iron by confining heat to the sole plate where it belongs. The cover design also gives the Presto iron a leak-proof, corrosion-proof water storage tank of 9-oz. capacity, which is said to be the largest of any iron that is currently on the market.

Little styling in early handles

Years of material improvement and refinement of molding techniques bridged the gap between today's highly advanced plastic iron handles and some of their early counterparts. The first plastic handles made no attempt at streamlined styling; emphasis was on greater durability, elimination of surface finishing and other practical advantages. One such handle, produced by Imperial Molded Products for Chicago Flexible Shaft Co. (now Sunbeam Corp.), was molded of a Bakelite phenolic compound having a high content of wood flour filler to minimize heat transmission. It was made in two parts, since it was not economical to mold thick sections with the relatively slow curing materials then available.

CUT-AWAY VIEW of Presto iron (see cover) indicates importance of one-piece phenolic handle and cover (underside shown, left) to final design. Knob is also phenolic. Reservoir base and sole plate (right) are only major metal parts.

As molded plastic iron handles became more generally adopted, their styling possibilities came under the scrutiny of designers and they advanced well beyond the turned wooden handle design approach.

However, as these sculptured handles evolved, eliminating the metal end supports used on earlier irons, practical problems arose. Because this type of handle brought the phenolic material into direct contact with the top of the iron at both ends, gradual charring took place. This problem, in turn, was overcome by substituting a high temperature, mineral filled type of phenolic. Unfortunately, its rate of heat conductivity was such that any but the most calloused hands needed the protection of a potholder or other makeshift insulation to use the iron. Finally, the entire problem was resolved by raising the handle slightly from the top of the iron by means of standoffs, making it possible to return to phenolics having a high wood flour content and good thermal insulating properties.

With modern transfer molding techniques and today's improved phenolic materials, intricate coring, undercuts, inserts, and other features are possible in producing an iron handle. Back in the days when only straight compression molding was available, the biggest single problem encountered as handles grew more complex was to get the material to flow properly and fill out the mold. Split cavity molds were used to produce these parts, and molders had to exercise considerable ingenuity. At Imperial Molded Products, for example, a Baldwin-Southwark 200-ton press was rigged so that a hanger would grab the mold and swing it aside so it could be opened.

One of the first iron manufacturers to incorporate unusual construction features in molded plastic handles was Proctor Electric Co., Philadelphia, Pa. This organization turned to phenolic as an ideal handle material for its Never-Lift iron, which was designed with a retractable base support making it unnecessary to lift the iron each time it was put down while in use. For this application, the basic design principles were first worked out with a wooden handle and lever mechanism extending down the back of the iron, then plans were drawn for a hollow, one-piece phenolic handle which would enclose the required levers and other parts of the working mechanism. With the molded plastic construction, **(To page 203)**

How to market-test a material without production delay

ABS-housed spark plug analyzer comes to market in sheet-formed parts while injection molds are still being cut

Step into production fast—in a matter of *weeks*—with parts thermoformed from selected sheet stock. Get the finished unit into the field, in volume, to start sales rolling and to confirm material selection and part design. Then swing over to injection molding for the long pull on future market requirements.

This streamlined manufacturing approach, again highlighting the versatility of plastics, was followed by the AC Spark Plug Div. of General Motors Corp. in bringing out its new ACilloscope, an electronic spark plug analyzer which makes it possible to observe individual spark plug performance in a running engine.

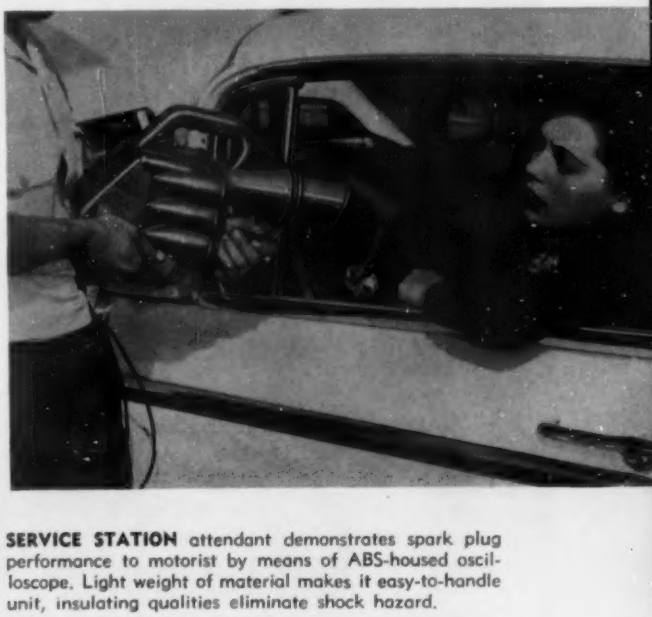
Resembling a futuristic ray gun in appearance, the ACilloscope is housed in a Cycolac (Marbon Chemical's ABS copolymer) case made in two matching halves. The case, weighing slightly more than 1 lb., houses the electronic tube, wiring, terminal boards and other internal components of the tester. Molded in red, the housing is designed with an integral base, two built-in handgrips which facilitate portability, and a flared, muzzle-like front within which electronic patterns produced on the recessed tube face may be observed.

Why ABS was selected

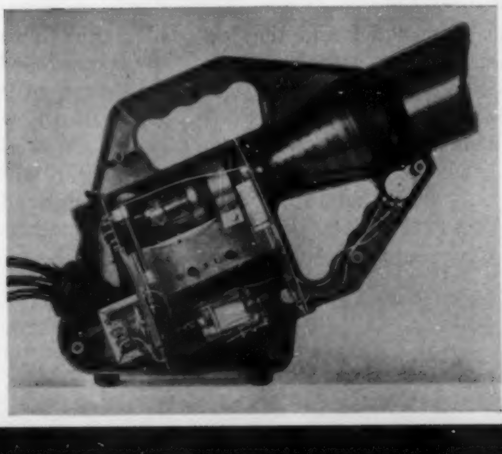
According to AC Spark Plug Div. engineering and service representatives, the selection of an acrylonitrile-butadiene-styrene case for the ACilloscope was based on the following three primary factors:

1. Economy. While no exact figures are available the plastic case resulted in cost savings, since a metal housing would have required extensive insulation and changes in the circuit board.
2. Durability. It was recognized that a metal case would be likely to dent if dropped or struck a sharp blow.
3. Availability of integral, permanent color without use of paint or other surface finish.

The importance of these points becomes clearer when one considers the conditions under which the instrument is used. The very high voltage built up in a spark plug when an engine is operating requires that (To page 205)



SERVICE STATION attendant demonstrates spark plug performance to motorist by means of ABS-housed oscilloscope. Light weight of material makes it easy-to-handle unit, insulating qualities eliminate shock hazard.



ONE HALF OF HOUSING, with electronic components in place. Note internal supporting ribs and cored bosses for bolting halves together.

For traffic blinker light component . . .

BLOW MOLDING

Redesign of the Head of a traffic barricade blinker light in blow-molded, high-density polyethylene has not only reduced the cost of the component by 50%, and decreased the cost of the complete marker by approximately $10, but also has achieved a 9-lb. weight reduction. And by making the twin blinker lenses with acrylic—instead of glass—an additional 50% cost saving and 65% weight reduction for these parts were realized. The housing represents one of the first large industrial applications of the blow-molding technique outside the packaging and toy areas.

Used by gas, light, and power utilities; gas transmission line firms; contractors—many of whom are now building the multi-million dollar federal highway network—and other construction companies; the street and highway barricades were formerly made with an all-metal head and stand.

Plastic head more durable

The polyethylene head is a distinct improvement, however, as it does not rust, chip, or dent, and it is not affected by the corrosive action of defective or worn-out batteries, which power the blinker lights. The lightweight, one-piece head offers greater ease of replacement, while damage in the field is less than half that of the metal models. And the lighter unit means greater savings in transportation costs. Another factor in the redesigned unit's favor is the fact that the weight is now concentrated in the base —where it should be—and there is much less tipping over.

Measuring 24 in. high and 9¼ in. wide, the blinker light head is blow molded by DeWitt Plastics, a division of Shoe Form Co. Inc., Auburn, N. Y., for Walter Roberts Enterprises Inc., Cazenovia, N. Y. The high-density polyethylene head weighs 1⅓ pounds.

"We expect about 10,000 to 15,000 of these barricade markers will be put in use this year," says David E. Gregory, sales manager for DeWitt Plastics. "The potential market is at least two or three times this estimate; but, of course, adequate distribution facilities pose a problem for a small company."

The New York firm blow molds the heads on Model 250V Air-Formed Products Corp. machines—which have combination 2 and 4 parison manifolds—using Union Carbide 4901 NT polyethylene, which is dry-colored yellow.

Holes for the lenses are made by the machine operator in a secondary operation. While the mold is cooling, he removes the excess material at the parison pinch-off, then cuts the openings, using a fly cutter on a jig that automatically lines up the piece for cutting.

Total weight of the new stand and blinker light is 21 lb., compared with approximately 30 lb. for the metal unit. The former metal head and stand cost about $40—against $30 for the new marker. The price comparison, however, is not an accurate gage of savings, since the redesigned units have a cast iron base, which is a decided improvement over the sheet metal that was previously used. Actually, the cost of the plastic head itself is about half that of its metal predecessor.

The stand for the new model is a simple piece of 3½-in. O.D. pipe and cast iron pedestal base. A Marathon No. 496F battery and flasher unit fit inside the pipe.

Acrylic lenses better, cost less

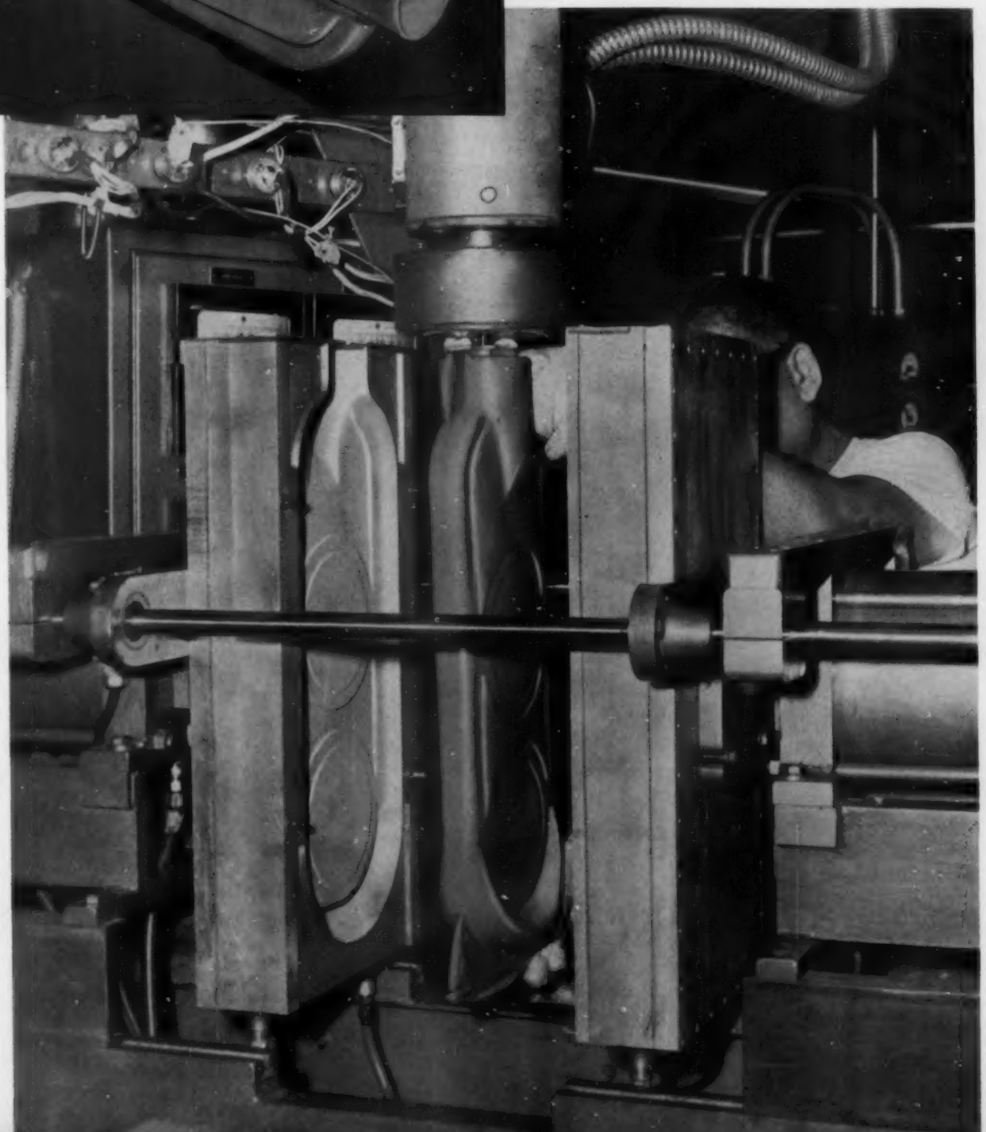
The 7-in. lenses are injection molded with Rohm & Haas acrylic by Do-Ray Lamp Co. Inc., Chicago, Ill. Acrylic was given the nod over previously-used glass because of: 1) 65% weight savings; 2) 50% cost savings; 3) greater reflective quality; 4) greater candlepower output; and 5) less breakage.

An analysis of blow molding markets made a year ago found that a "good many (blow molded) industrial products . . . were developed in Europe." This product is champion when it comes to United States development. But now that as large an item as this blinker light head has been successfully blow molded here, it will not be long before other large blown industrial products will be developed and marketed in this country.—End

brings 50% cost reduction

BLINKER LIGHT HEAD, which is dry-colored yellow, weighs 1⅛ lb. without the extra fixtures. Old metal unit weighed 11 pounds.

BLOW-MOLDED POLYETHYLENE barricade blinker light, which measures 24 in. high and 9¼ in. wide, was formerly made of metal. Operator removes excess material and cuts holes —using a fly cutter—for the twin blinker lenses while the molds are cooling.



Climaxing nearly five years of design, development, laboratory testing and market research work, Sears Roebuck & Co., Chicago, has just announced the first line of injection molded polypropylene to reach the market. Offered under the name of Forecast and available in a selection of five colors and nine styles for men and women, the new Sears line marks an important milestone in plastics' growing penetration of the luggage field.

The complete matched Forecast line includes a hat box, train case, 18-in. overnite case, 21-in. weekend case, and 24- and 27-in. pullman cases for women, plus a two-suiter, a three-suiter and a companion case for men. Molded shells used for the women's and men's cases are identical; differences in the two are in the interior fittings only.

With the exception of the ladies' train case, which requires a shallow lid and a compartmented tray molded of styrene in colors to match exteriors, all pieces in the Forecast line consist of two identical injection molded shells, joined at the lower inside edge by heavily plated steel piano type hinges. Secure closure between the interchangeable halves is obtained through use of ribbed aluminum alloy valances which interlock when the case is closed, sealing out dust and dirt. The metal moldings are pressed into position over the edges of the plastic halves and mounted permanently in place by concealed rivets. The polypropylene material, designated as Titanite by Sears in advertising and promotion of the luggage, was found to be particularly effective in the fastening of hardware and other components, since it does not have a tendency to open up or loosen around rivet holes.

The injection molded shells for Forecast luggage, as well as the dividers, are produced for

Molded polypropylene:

FIVE YEARS of development and testing went into the creation of Sears' new line of polypropylene luggage. Three of the molded shells used in this set of women's luggage are also used to produce the men's cases.

Sears by Amos Molded Plastics, Edinburg, Indiana. The material used is Pro-fax 65A4, a modified formulation of polypropylene developed by Hercules Powder Co. to obtain improved impact characteristics at low temperatures. Hercules worked closely with Sears during the development and testing of the luggage designs and materials. Handles, produced by Kusan Inc., 3206 Belmont Blvd., Nashville, Tenn., are molded of an elastomeric vinyl material, in colors selected to match the cases—blue, charcoal, green, white, and tan. Molds for the luggage shells were built by A-1 Tool & Die Co. Inc., Youngstown, Ohio. All finishing operations on the luggage, including installation of hinges, handles, linings, etc., are performed by Sardis Luggage Co., Sardis, Miss.

All the new Sears luggage shells are produced in single cavity molds, requiring a total of six shell molds plus that for the train case lid and another for the train case tray. Multiple gating is used to insure uniform distribution of material and rapid filling of the mold cavities. Cycles are as short as possible consistent with quality production standards.

Upon removal from the injection machines, the polypropylene shells are immersed directly at the press in a detergent solution. The purpose of this procedure is to inhibit static dust attraction during finishing, shipment, display and sale of the luggage. No cooling fixtures are required for these parts.

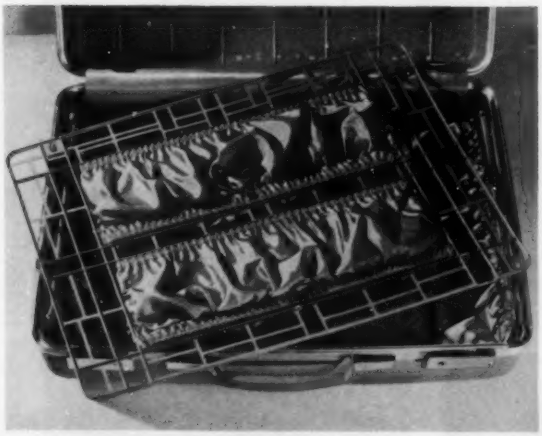
Why polypropylene was chosen

What are some of the performance properties and other qualities which make Sears' new Forecast molded luggage appealing to the consumer? A number of these features could be cited, namely:

Light weight: Made of the lightest plastic

Sears' choice for luggage

Styling, strength, light weight, economy: five years of development and torture-testing proved PP could deliver them all in luggage



POLYPROPYLENE is also used to form center dividers in the cases (above). Flexible open grid design was used to cut weight, accommodate bulky items.

now commercially available, the cases are remarkably light and easy to carry. For example, the weight of a finished 27-in. ladies' pullman case is only 9¾ lb., compared to 11¼ lb. for corresponding sizes of other luggage now on the market. This is particularly important to air travelers, who must pay a penalty for excess luggage weight.

Low cost: Lending itself to mass production and eliminating many of the costly assembling, glueing, lining, binding, stitching, and other operations required with conventional luggage, the Forecast line is very competitively priced. Typical retail prices are approximately \$19 for the train case, \$20 for the ladies' 21-in. weekend case, and \$32 for the men's three-suiter.

Mar proof: In normal use, it is practically impossible to deface or damage the polypropylene luggage. Lipstick, fingernail polish, polish remover, mustard and other food products—even

CASE HANDLES (left), spring-mounted to retract when not in use, are of elastomeric vinyl.

acid—can be spilled on the luggage and washed or wiped off without damage, thanks to the material's extremely high chemical resistance. The grained surface is difficult to mar, even deliberately. If a minor scratch should occur, it can be very easily buffed off with sandpaper or steel wool.

Strength: Recognizing that in today's high-speed travel luggage must be able to absorb a terrific amount of punishment, Sears luggage officials and laboratory technicians put the new Forecast cases through a most strenuous routine. In addition to extensive laboratory testing, the plastic cases were sent all over the world under typical travel conditions. In all, more than 500,000 miles of closely documented travel testing was recorded before the line went into production late this summer. Some of the testing highlights:

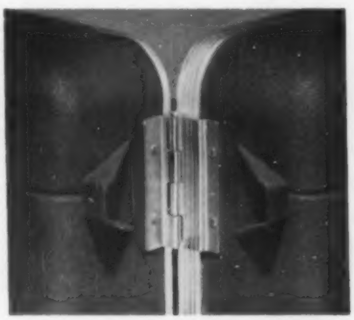
- A 21-in. case, packed with sand bags to a total weight of 37 lb., was subjected to 2,000 revolutions in a 7-ft. tumble drum fitted with internal projections which buffeted it from every angle. Result—some very slight scratches and "buffing" at the corners; no breakage or failures of any kind.
- With weight increased to 50 lb., the case was mechanically lifted and set down by the handle approximately 100,000 times, with no loosening or failures.
- Lifting the loaded case 25,000 times by the locks, putting its complete weight at the point of contact between the locks and the molded plastic shell, caused no measurable damage. Locks showed no tendency to loosen their attachment to the shell.
- In cold impact tests, designed to measure the ability of the cases to withstand punishment after low-temperature exposure, cases were held in a freezer at a temperature of minus 20° F., then exposed to drop tests with a 4-lb. steel ball. These tests were directed at the corners, where such impacts are most likely to produce damage. Cases demonstrated their ability to withstand severe impacts at these temperatures without damage. In a related test, a 21-in. luggage case that was loaded to 35 lb. was withdrawn from a freezer at —20° F. and dropped on the corners to a hard surface with no damage.
- The effects of high temperature were also investigated. In one of many tests, cases were placed in an oven with a 20-lb. weight upon them. Temperature was then raised to 150° F. and held there for 48 hr., simulating conditions which might occur in an auto trunk compartment with the vehicle parked under a blistering sun for long periods with a weight resting on the case. An interesting point revealed here was that even when a slight indentation resulted in the side of the case, the polypropylene recovered its original contour soon after being returned to normal temperatures.

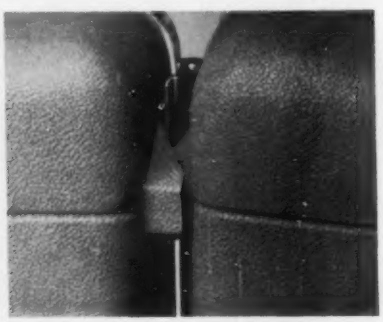
In turning to polypropylene for its new luggage, Sears found it had a material which permitted attachment of high-strength fittings to match its own ruggedness and utility. For example, each Forecast case is equipped with a molded elastomeric vinyl handle, grained to match that of the cases. A metal insert within the handle provides additional strength. At the ends, handles fit into chrome-plated diecast studs. Spring tensioned at the ends, the handles lift up for easy carrying and retract to a lower position when pressure is released.

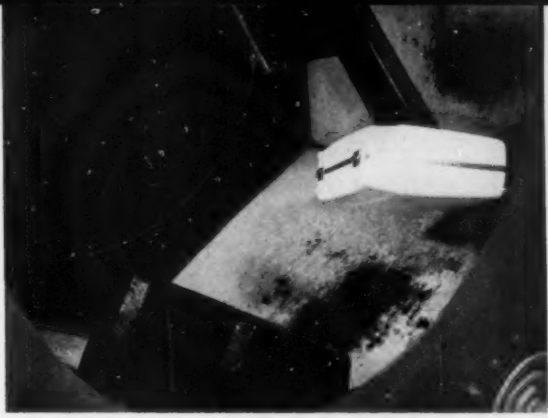
Molded feet proved rugged

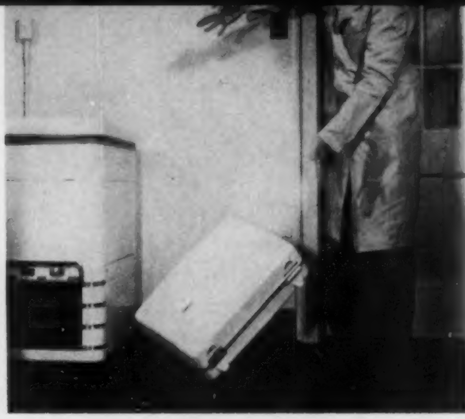
Integrally molded feet are another interesting feature of the new Sears Forecast luggage. They eliminate the need for attachment of separate feet which might become loosened and lost. Due to the tapered design of the feet and the

FEET OF CASES, integral parts of molded shells, have stood up under extremes of use and testing. Feet are offset on paired shells of each bag so that they nest, permitting bag to be opened flat for convenient packing.

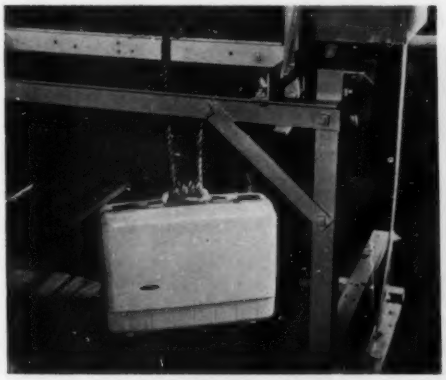








Torture tests proved polypropylene's invulnerability to handling hazards



MOLDED POLYPROPYLENE material came through with flying colors in lab torture tests designed to duplicate extremes of rough handling. Shown clockwise from top left: 1) tumble bin; 2) drop tests at 20° F.; 3) handle lift (100,000 times). Actual in-use tests, ranging from trips by jet to mule train, duplicated findings of the laboratory, showed that any scuffs or mars (photo 4) could be sand-papered off.

offset mounting of the hinges, the feet do not strike each other when the case is opened flat for packing; instead, they nest.

Still another unusual feature of the new injection molded luggage is molded polypropylene dividers, made in a total of six sizes to fit the different cases. Instead of the conventional solid construction, the Forecast dividers are in the form of flexible, open grids. This design reduces weight and bulk, enables the dividers to conform even to a somewhat lumpy packing job, permits air circulation within the case and also enables the user to see what is on the other side of the divider without having to lift it up. The dividers are molded with a solid, thin-section center area which forms a support for the cloth storage pockets. Easily removable, these dividers are held by convenient snaps.

In the ladies' cases, Sears designers came up with the practical innovation of luxurious Chromespun linings and accessory pockets which may be unsnapped and removed for rinsing out, dry cleaning or eventual replacement. With linings and accessory pockets removed, the entire case may be washed with soap and water.

The line is now being distributed to key retail outlets and made available through the Christmas catalog. Distribution is expected to be fairly complete in time for the holiday season, which accounts for approximately 40% of annual luggage sales.

The luggage industry, whose annual volume on a manufacturers' cost basis now runs approximately $125 million per year, is understandably interested in Sears' comprehensive program with the new polypropylene Forecast line. Plastics in recent years have been moving ever more strongly into this market, with formed thermoplastic shells, vinyl-metal laminates, and reinforced plastics spearheading the drive. If Sears' new "giant step" into molded polypropylene luggage proves out as favorably as all portents now indicate, molded thermoplastic luggage could quickly become a leading contender in this hotly contested field.—End

Premix in foghorn:

- *TRIPLES PRODUCTION*
- *SAVES $76/UNIT IN MATERIALS COSTS*
- *SAVES $29/UNIT IN LABOR COSTS*

HALF-MILE FOGHORN of polyester-glass premix construction stands slightly over 4 ft., has 17⅜-in. diameter. There are 23 plastics parts.

When a reinforced plastics product becomes too costly to fabricate by the hand layup method, a processor must consider other techniques. When, at the same time, production rate starts to lag behind sales, the processor has a doubly difficult task. He must find a production method that will bring overall costs into line with his budget and supply into line with the demand.

Faced with just such a problem, the Plastics Dept. of Wallace & Tiernan Inc., Belleville, N.J., came up with a solution—a change to premix molding. The results: tripled production, a savings in materials costs of $76 per product and a saving in labor of almost $29 per product.

RP replaced initial bronze

About three years ago, the company went from costly bronze castings to reinforced plastics for one of its more unique products, marine foghorns of half-mile range. It was produced by hand layup of glass fiber fabric and polyester resin in reinforced epoxy molds. With the RP horn, material and labor costs were cut 15% and production was quadrupled. The foghorn proved to be corrosion resistant, watertight, and easy to maintain, and it won a merit award for design from the Reinforced Plastics Div., Society of the Plastics Industry.

So successful was the foghorn that the hand layup production rate, two horns per 12-hr. day, was unable to keep up with customer demand. The longer working day meant that high labor costs were added to the high costs of the glass cloth, gel coat, mold parting agents, and catalysts required with hand layup. Therefore, when cost analysis indicated that premix molding would provide: 1) definite labor and material economies; and 2) the write-off of the expense of a matched metal die when 300 horns had been produced, a volume already attained by the company, the decision was made to switch to the faster premix process.

Also at this time, company designers had come to accept reinforced plastics as structural materials. For this reason, the one major metal part in the original RP foghorn, an aluminum casting housing the operating mechanism, was eliminated, along with 40 lb. of weight and $40 worth of casting and machining operations. In the new horn, the mechanism is mounted on molded in bosses in the RP structure.

The redesigned foghorn consists of 23 plastics parts, 16 of which are identical divider vanes. The seven remaining components are the base,

two halves of the center section, two halves of the throat section, the top cone, and the cover. Weight of the horn is 120 lb., with 74 lb. of this total being plastic weight. Parts weights range from about 1 lb. each for the divider vanes to approximately 15 lb. for the top cone.

The polyester-glass premix formulation, developed by Wallace & Tiernan, is presented in detail, below. The company (To page 207)

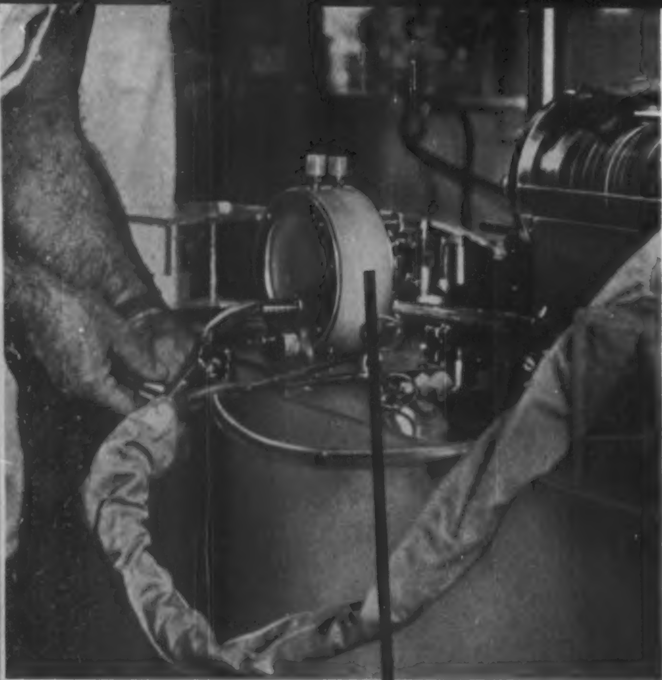
OPERATOR OF 75-TON PRESS (right) removes foghorn component from male half of matched metal die. Part was molded from measured premix charge, will be bonded to part at left to form foghorn's center section. Portion of center section (left) is removed to show location of throat assembly, which distributes foghorn signal in two directions. Like center section, throat consists of two halves bonded together by epoxy-based adhesive.

PREMIX-MOLDED BASE and top cone are ready for assembly to center section. Molded-in slots in both components will be fitted with divider vanes, which direct foghorn's signal.

[illegible]

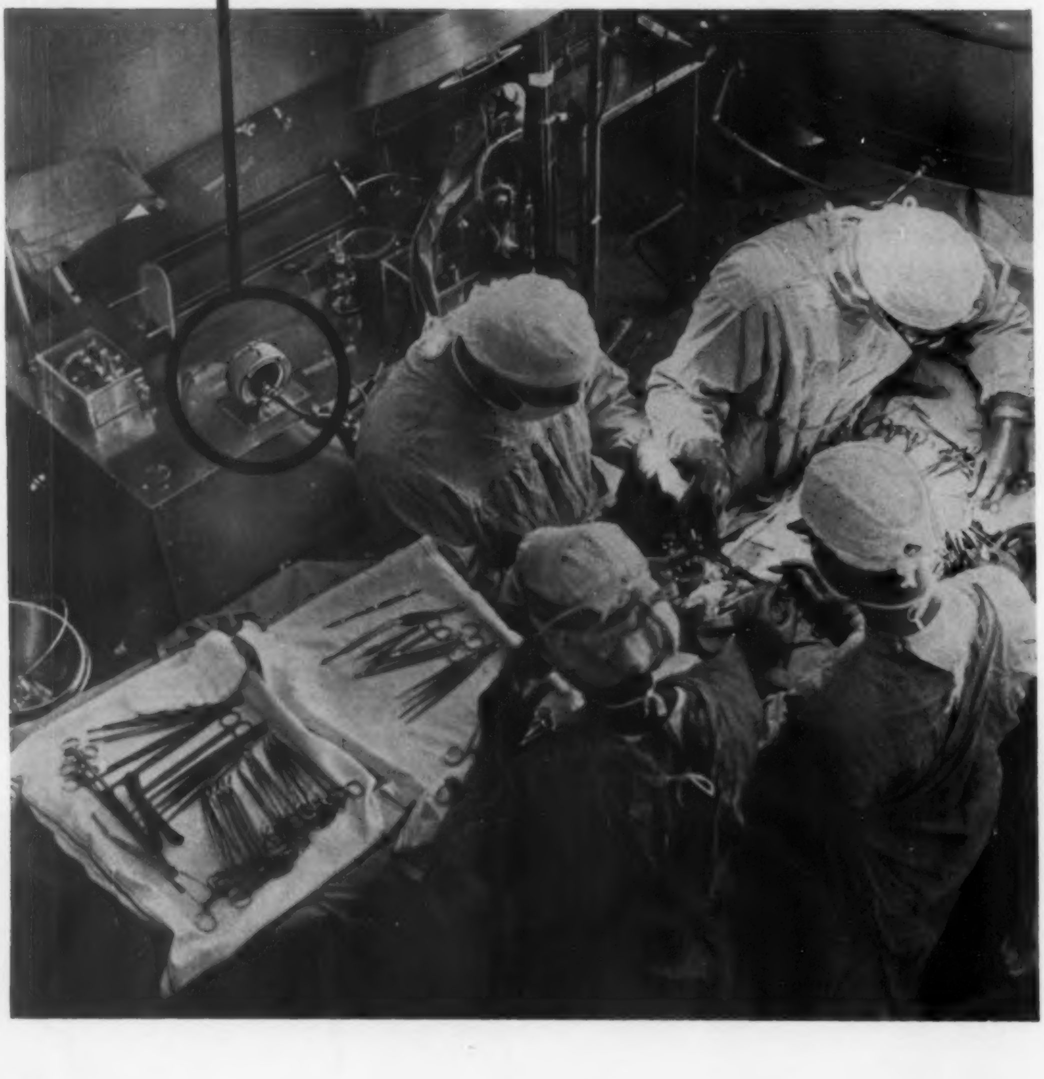
Ingredient	Material	Parts by wt.
Resin	polyester	100.0
Reinforcement, larger parts	coated glass fibers	60.0
Reinforcement, smaller parts	¼-in. chopped strands	60.0
Filler	calcium carbonate	150.0
Filler	aluminum silicate	10.6
Filler	asbestos fibers	3.0
Catalyst	benzoyl peroxide, 50% sol.	0.1
Catalyst	T-butyl perbenzoate	0.5
Inhibitor	P-Benzoquinone sol. (1 to 100 in styrene)	0.4
Mold release agent	zinc stearate	6.0
Pigment	fire-red powder	10.6

For list of suppliers, see p. 207.



Fluorocarbon

PLASTIC FILTER (see color indicator) is being connected to heart-lung machine before surgery begins. Operation is performed at Brooklyn Jewish Hospital, where the new unit has been used for cardiac surgery for over 2 years.



aids heart surgery

Non-wettable, autoclavable material overcomes shortcomings found with previously used materials

A rapid-quench technique that imparts transparency to normally translucent Kel-F fluorocarbon disks has made possible the adaption of this material for a new arterial blood filter used in open-heart surgery. The transparent property is required to permit visual observation of the circulating blood to detect dangerous air bubbles.

Kel-F was selected for this application because it overcame two problems encountered with conventional units (which used glass or methacrylate in the filter element).

1. Conventional filters must be coated with a silicone before use because the materials of construction may cause blood damage. Kel-F, according to Minnesota Mining & Mfg. Co., producers of the material, is compatible with blood and does not require special treatment.

2. Previously used filters were not autoclavable and had to be processed by a tedious cold-sterilization technique that involved soaking them in a cleaning solution. Kel-F filters are fully autoclavable.

Filters consist of two disks of plastic, each 6 in. in diameter and 1 in. thick. They are molded by Sanford Plastics Div., Bonny Mfg. Co., Maynard, Mass., using standard injection machines running at 500 to 550° F. Rao Instrument Co., Brooklyn, N. Y., manufacturer of the filter, machines the molded disks to final dimensions and produces the transparent "window" in the center. The window is produced in the following manner:

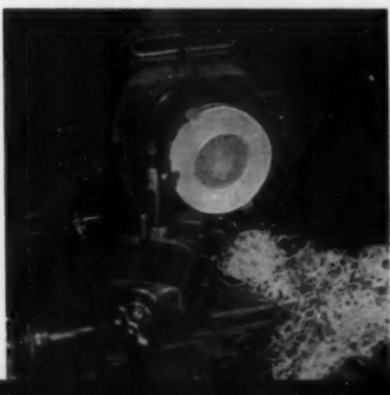
An area 3½ in. in diameter in the center of the 1-in.-thick disk is machined to a thickness of ¼ inch. This area is then heated by contact with two metal disks (see photo, below), and quenched in cold water, producing an amorphous state in the window section.

Kel-F has two physical structures in the solid state: amorphous and crystalline. In the amorphous state it is transparent up to approximately ¼ in. thick. In the crystalline state Kel-F is translucent. To induce the amorphous state, a rapid quench is required as the material changes from a molten to the solid state.

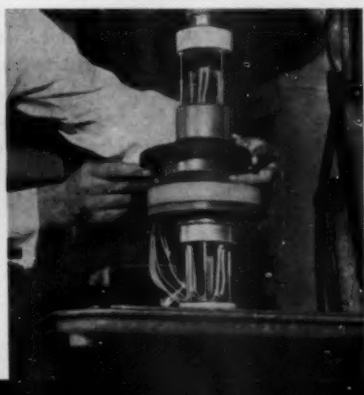
When the filter is assembled, a #60 mesh stainless steel screen is mounted between the disks. Because of the transparency of the window, blood passing through the filter can be observed for the presence of air bubbles that could cause deadly air-embolism in the patient. These bubbles are vented out of the filter through two small vents on top of the filter.

The new unit has been used in cardiac surgery at Jewish Hospital, Brooklyn, N. Y., for almost two years. According to Dr. A. A. Bakst, New York surgeon who invented the unit, Kel-F is the only material available which is non-wettable, does not traumatize the blood elements, and is completely autoclavable without requiring cold sterilization.—End

"WINDOW," 3½ in. in diameter, is machined into 6-in. molded disk. Overall thickness of disk is 1 inch. Window area is only ¼ in. thick.



HEATED PLATES are used to heat the machined disk to a molten state. It is then immediately quenched in cold water. This produces an amorphous condition and makes the window transparent.



DISK AT LEFT has been postheated and quenched to make the window transparent. At right is molded disk before machining. Two disks are required for each blood filter, enclosing a sheet of #60 mesh steel screen.

Melamine

ATTRACTIVELY STYLED in its melamine housing, desk-top laminator provides reliable performance, thanks largely to carefully engineered nylon operating components.

Total cost savings estimated at from $50,000 to $100,000 per year have been achieved by American Photocopy Equipment Co., Evanston, Ill., through adoption of a molded melamine cabinet for its new Apeco Ply-On laminator. This compact table-top office machine, retailing at $335, automatically encases either or both sides of an original document or letter with a durable protective covering of transparent polyester film. Laminating both sides of an 8½- by 11-in. sheet, the operation requires less than 10 sec. to complete, and it costs less than 8 cents.

According to the manufacturer, the laminator could not have been marketed at the price listed above without the cost savings afforded by the melamine housing. A cast or drawn metal housing, for example, would not only have involved more costly initial tooling, but would also have required expensive, time consuming finishing operations. With the plastic housing, the molded parts have an attractive "built in" color which cannot be rubbed off. Also contributing to reduced manufacturing cost and efficient performance are nine internal components injection molded of nylon.

The five melamine components, which assemble over the basic steel structure of the laminator, include the left and right end bells, the large front bezel which spans the width of machine, the platen, and the platen hinge plate, on which papers are placed to be fed between the laminating rolls. These parts are produced by Chicago Molded Products Corp., using melamine supplied by American Cyanamid Co. CMPC also produces four injection molded nylon hubs which function as bearings on the ends of the upper and lower film rolls.

How materials were chosen

The molder worked closely with Charles E. Jones & Assocs. Inc., Chicago product stylists, in creating the melamine housing. In cooperation with Apeco engineers, a number of possible materials and fabricating methods were studied before selecting melamine for this application. Its adoption was encouraged by Apeco's favorable experience with a molded

preferred to metal

Cost was main reason why manufacturer of desk-top laminator chose molded melamine cabinet and nylon operating parts for new unit in his line of business machines

melamine housing for its Uni-Matic Auto-Stat copying machine (See "Photocopier swings to plastics," MPl, Sept. 1958, p. 108), where a 4:1 cost advantage was realized over a comparable stainless steel enclosure.

Clayton Rautbord, Apeco vice-president, states that melamine was specified for the laminator housing because it combines high heat resistance and high strength. Internal heat released during the laminating operation has no effect on the dimensional stability of the thermosetting material. In addition, the manufacturer points out, melamine has the smooth, hard surface needed for easy cleaning and maintenance. The material also possesses adequate abrasion (To page 208)

MOLDED melamine parts of laminator include (clockwise, from top) front bezel, right end bell, front platen hinge and platen, and left end bell.

FIG. 1: Assembled model of female reproductive organs consists of 10 molded parts, of three different styrene formulations. Exact dimensions were required, both to allow for exact fit and positioning of diaphragm and to permit ease of removal and reattachment of side plaque by physician.

Precision engineering solves production problems for:

PELVIC MODEL IN PLASTICS

Taking a cue from the successful use of plastics in industrial models, Ortho Pharmaceutical Corp., Raritan, N. J., has come up with a unique anatomical model—an authentic "see through" and "take-apart" reproduction of the vaginal canal and surrounding organs—molded entirely of styrene. However, unlike industrial models, the intricate configuration of the anatomical model and the extremely close tolerances it had to meet turned the job into an unusual example of "precision engineering." Despite the problems, Ortho and the molder, Madan Plastics Inc., Cranford, N. J., managed through close cooperation to short cut the route from drawing board to production line—at minimum cost and in minimum time! Here is how they did it.

The basic design

As conceived by Ortho (and developed for them by G. Butler and W. Doerfler, Nyack, N. Y.), the three-dimensional model is used by physicians as a training aid to properly and discretely demonstrate contraceptive techniques to their patients. By taking advantage of the full range of available styrenes (general-purpose, medium-impact, and high-impact are all used), the designers found they could trade on the plastics' transparency (previous models were made of plaster, rubber, or other opaque materials) while still building the necessary flexibility into those sections that required it.

The big problems, however, centered around the required precision in the molded parts. Since the model was designed to receive an actual 75-mm. diaphragm during the physician's demonstration, close tolerances were absolutely necessary to insure a perfect fit. In addition, the number of parts that would eventually make up the model had to be kept to a minimum and so engineered that they would mate perfectly to facilitate withdrawing and replacing the various parts during the demonstration by the doctor.

It was at this point that Madan Plastics entered the picture.

After an analysis of the problem, it was decided that 10 separate molded parts would be needed. These consisted of the following: 1) two transparent side plaques which would form

the vaginal opening and represent the walls of the internal cavities in which the uterus and ovaries would be mounted. These were designed so that one such plaque could be easily withdrawn to clearly expose one half of the internal organs for doctors' explanations of the tract (see Fig. 1). 2) A C-frame to support the plaques, to be molded with an integral base (see Fig. 2). 3) A base with padding to prevent marring the surface of the desk on which the base was placed. 4) A four-piece set of parts to form the two halves of the split uterus: two shells with inset faces; shells and faces to be two different shades of pink. 5) A two-part set of left and right ovaries with fallopian tubes (see Fig. 3).

Since all 10 parts were required to mate exactly, and required three different molds, precision design was essential. A particularly difficult part was the medium-impact sytrene C-frame and base. (See Fig. 2) An internal slot had to be molded on the inner face of the "C." Further complicating matters was the need for two slots in the surface of the former slot, to anchor one side plaque in the frame so that both plaques would not come out of the frame when one side was removed by the doctor to reveal the internal organs. Also taboo were any prominent mold parting lines. The parting line on the outside edge of the "C" was masked by designing in a relatively sharp edge. However, this parting line continued to the lower edge of the base and the only way to keep it at a minimum was to key the mold so that halves would mate properly.

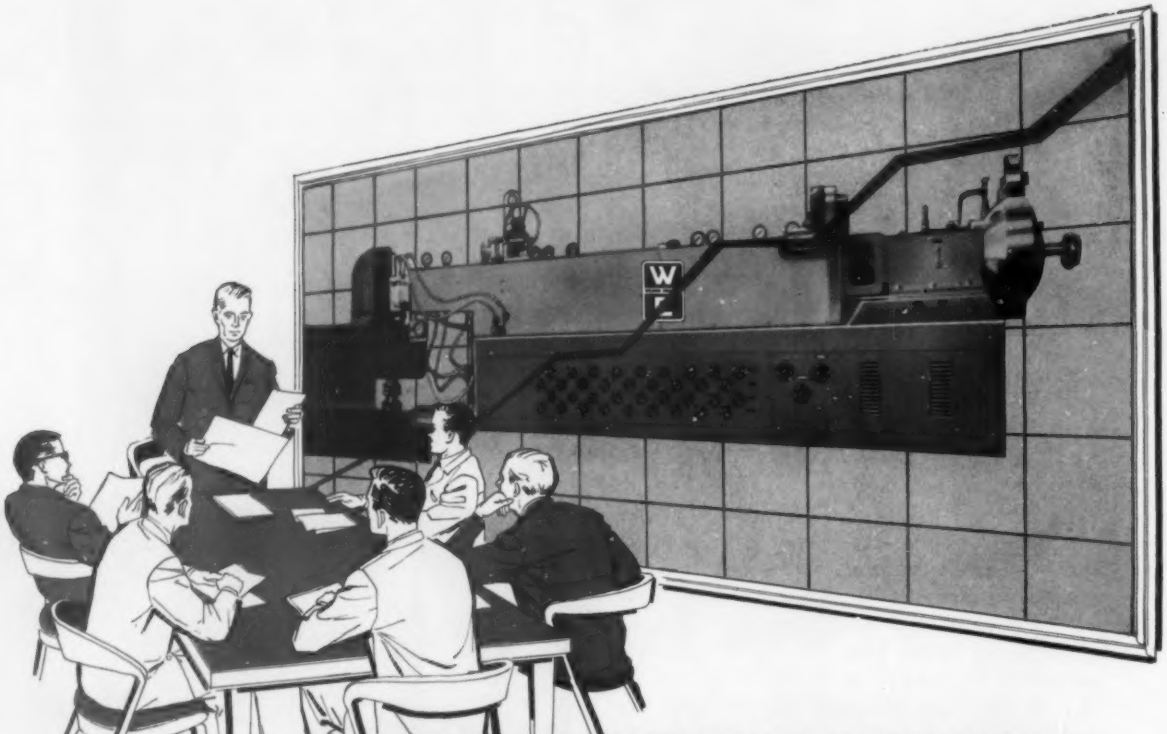
The molding of the slot and hollow base also called for wedges and cams in the mold. To work out the cam actions needed, a pilot wooden model of the mold was built to check the movements. Although three runners are provided, in the final mold design only one gate was cut at the lower end of the frame opposite the base at a point calculated to balance the shot. Poor fillout was expected, but this calculated gate location worked perfectly on the first shot and no other gates were cut.

The general-purpose polystyrene side plaques had to fit without excessive play; however, it was required that the removable plaque slide out easily when necessary. This required that the part eject exactly flat from the mold. To insure this, small air ports were built into the cores forming the organ cavities so that a vacuum would not be formed on the inside of the plaque and result in distorting the part as the knockout pins moved it off the core. Here again careful design of the mold paid off and the first shots came out of the mold with no trouble. Side plaques had to be distortion-free for the additional reason that the small uterus and ovary parts had to drop exactly into place and not project above the mating surfaces of the two side plaques.

In addition to the molds for the base and side plaques, a family mold with cavity shut-offs was used alternately to mold the uterus and ovaries in two different pink colors. Dry colored, high-impact polystyrene (To page 211)

FIG. 2: Basic units of model are C-frame and base (top); two side plaques which enclose reproductive organs. Painted areas of plaque at right show bone and non-reproductive tissue areas.

FIG. 3: Intricacy of mold design needed to reproduce organs is apparent in these component parts. From left: cross section of inner lining of uterus; one of a pair of ovary-fallopian tube components; outer covering of uterus cross section showing slot into which extremity of previous component is fitted.



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George R. Smoluk, Engineering Editor

Why biaxially oriented pipe?

New process and equipment applies two-way stretch to produce high-density PE pipe having equal burst strength but only half the wall thickness and weight of standard pipe

By W. E. Gloor†

Two-way stretch has long been a popular slogan in the girdle business. A new procedure for strengthening pipe, recently developed by Farbwerke Hoechst A.G., in Germany, applies this idea to make linear polyethylene pipe twice as strong as that previously available.

Farbwerke Hoechst A. G. has protected this development by patents and patent applications in many countries, including the United States and Canada. Hercules Powder Co. has been granted an exclusive license in the United States and Canada by Hoechst pertaining to apparatus and processes for manufacturing pipe from high-density polyethylene, polypropylene, and related polyolefins. Nonexclusive sublicenses in the two countries for manufacture of the apparatus and its use for making strengthened polyolefin pipe are available from the above company.

The principles on which the technique is based, the equipment required, and results obtained thus far are described in this article. The term "biaxial orientation" means the simultaneous application of orientation in two directions: that is, two-way stretched.

Principles involved

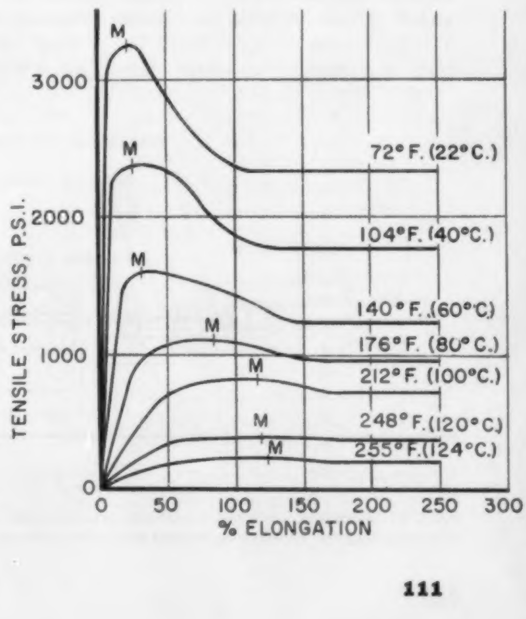
In a study of the cold orientation of high-density polyethylene, Richard and Gaube (4)[1] found that under tensile stress, compression molded test specimens maintained a uniformly stretched appearance until the tensile yield point was reached, and that further load increases resulted in localized necking-down. Fig. 1, below, shows the initial portions of a number of tensile stress-strain curves for such specimens measured at temperatures up to the polymer's crystalline melting point. Ultimate tensile stress values were about twice the stress at the yield point *M*. It was also found that at point *M*, denoting the transition from uniform stretching to necking-down, elongation reaches a value of more than 125% at 124° C. (255° F.). The total percent of extension at M, E_v, (also a measure of the amount of stretch) may be calculated from the relationship:

$$E_v = 100\ (A_o/A_v - 1) \qquad \text{Eq. 1}$$

where (To page 112)

[1]Numbers in parentheses denote references at end of article, p. 214.

FIG. 1: Stress-strain curves for high-density polyethylene at various temperatures up to the crystalline melting point. Tensile stretching rate was 2 in. per minute for all the curves.



*Reg. U. S. Pat. Off.
†Hercules Powder Co., New Product Development, Wilmington, Del.
This article is based upon an unpublished manuscript submitted to MODERN PLASTICS in April 1960 by Messrs. Dominghaus and Schiedrum of Farbwerke Hoechst A. G. vormals Meister, Lucius and Bruening, Frankfurt (M)/Hoechst. It gives background facts and more detail upon the process for biaxially strengthening pipe described in that manuscript, and aims to relate this to American practice in the plastic pipe field.

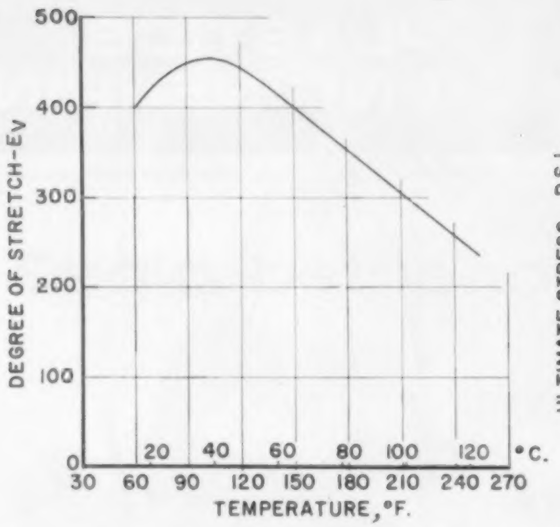


FIG. 2: Total extension at yield point, E_v, as a function of temperature. A stress of about 2350 p.s.i. is required to attain the 40° C. maximum at a loading rate of 2 in./min. See Equation 1, p. 111.

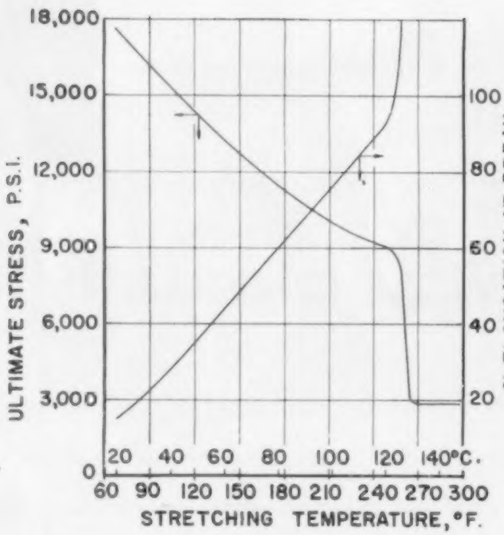


FIG. 3: Ultimate tensile strength and elongation of oriented tensile test specimens as a function of the orientation temperature. Tensile test conditions for both of these curves were 2 in. per minute at 68° F.

A_o = the original cross-sectional area, and

A_v = cross-sectional area as stretched, since there is no density change before and after stretching. Fig. 2, above, (4) shows the variation of E_v with stretching temperature. It will be noted that the amount of stretch possible without necking down, E_v, reaches a maximum at 40° C. (104° F.); a stress of about 2350 p.s.i. being required to attain this amount of stretch at the loading rate of 2 in./min. which was used. It is still possible to achieve a considerable amount of stretching and E_v of about 230%, at 120 to 124° C. Forces of only 50 to 80 p.s.i. are needed to attain this value at the same stretching rate. Less stress is required to reach the yield point at below 2 in./min., and more stress above, with only minor changes in the amount of stretch attainable without necking down.

When high-density polyethylene sheets 0.138 in. thick and 1.58 in. wide were thus stretched to the yield point at various temperatures, cooled, and their tensile properties measured at room temperature, the relations shown in Fig. 3, above, were obtained (4). Ultimate tensile strengths were at least three times greater than those found for unstretched sheet material. However, if the stretching temperature exceeded the crystalline melting temperature, stretched samples, when cooled, showed no increase in tenacity over the starting material as shown in Fig. 1. Also while unstretched material will have an initial modulus of 110 to 140,000 p.s.i., that stretched at 20° C. will show a higher modulus, on the order of 350,000 p.s.i. Properly stretched fibers and thin films give even higher tensile strengths than those shown in Fig. 3 (4).

Thus when high-density PE is stretched below its melting point to a degree not exceeding its ability to stretch without necking, and then cooled, it can be highly oriented—producing ultimate strengths and elastic moduli

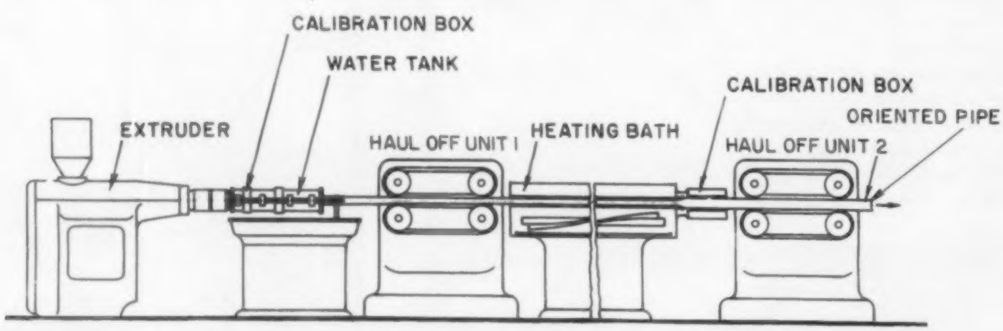


FIG. 4: Schematic diagram showing arrangement of extrusion line for continuous biaxial orientation of pipe.

which may be more than double the original value for the unstretched material.

Richard and Gaube (4) also showed that if a sheet, properly oriented in one direction, was placed in a flange as a diaphragm and hydrostatic pressure applied, it would burst at the normal stress of about 3200 p.s.i., with a split parallel to the direction of stretch. However, if an unstretched sheet were placed in the flange, heated to 120 to 124° C., blown to a hemisphere (thus imparting biaxial orientation), and then cooled, bursting stresses as high as 21,000 p.s.i. could be obtained.

These observations led to the development of the pipe orientation process about to be described.

General observations

Initial efforts to expand pipe at suitable orientation temperatures by passing it over a mandrel produced pipe which showed improved burst strength behavior in long-time creep tests. But pipe made this way did not improve the pipe's resistance to creep in

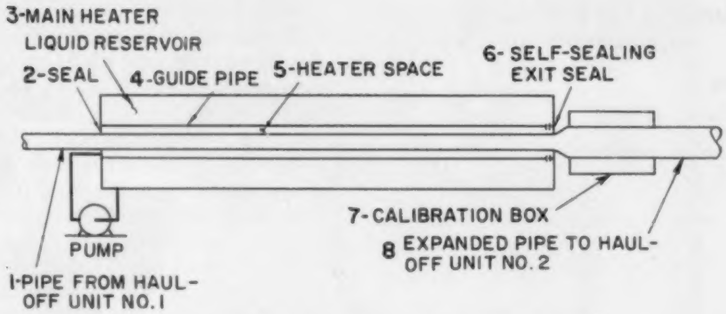


FIG. 5: Diagram of heating bath and calibration box used to uniformly heat pipe to orienting temperature as well as to control the radial expansion of the pipe, respectively.

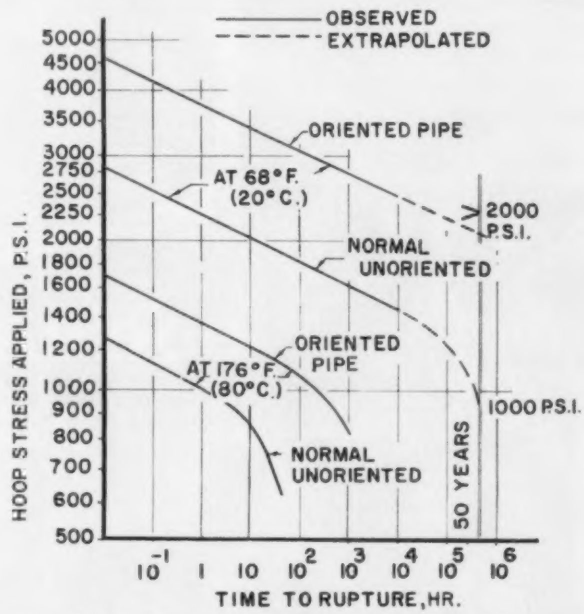


FIG. 6: Applied hoop stress required to rupture the pipe as a function of the time to rupture under the application of that hoop stress. Curves compare performance of oriented and unoriented plain end pipe at service temperature of 20 and 80° C. (68 and 176° F.).

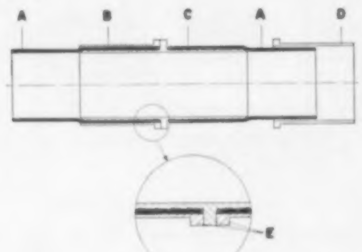
Table I: Comparison of oriented and unoriented high-density PE plain end pipe at 73° F.

Section	Pipe classification	Unoriented pipe[a] Nominal size	Unoriented pipe[a] Working pressure	Unoriented pipe[a] Inside diameter	Unoriented pipe[a] Wall thickness	Unoriented pipe[a] Pipe weight	Biaxially oriented pipe Working pressure[f]	Biaxially oriented pipe Inside diameter	Biaxially oriented pipe Wall thickness[g]	Biaxially oriented pipe Pipe weight[g]	Weight saving
		in.	p.s.i.	in.	in.	lb./100 ft.	p.s.i.	in.	in.	lb./100 ft.	%
A	Series 3[b]	1	100	1.049	0.105	15.8	200	1.049	0.048	6.85	56.5
		2	100	2.067	0.207	61.2	200	2.067	0.094	26.4	57.0
		4	100	[d]	[d]	[d]	[e]	4.026	0.183	100.0	[e]
		6	100	[d]	[d]	[d]	[e]	6.065	0.276	227.0	[e]
								Comparison of working pressures of threaded biaxially oriented pipe with working pressure of unthreaded, unoriented pipe			
B	Schedule 40[c]	1	122	1.049	0.133	20.3	244	Not comparable			
		2	78	2.067	0.154	44.5	156	Not comparable			
		4	62	4.026	0.237	131.0	124	Not comparable			
		6	50	6.065	0.280	230.0	100	Threaded pipe usable at 47 p.s.i.			
	Schedule 80[c]	1	183	0.915	0.200	29	366	Not comparable			
		2	126	1.875	0.250	69	252	Threaded pipe usable at 138 p.s.i.			
		4	90	3.626	0.337	178	180	Threaded pipe usable at 106 p.s.i.			
		6	78	5.761	0.432	348	156	Threaded pipe usable at 103 p.s.i.			

[a] Dimensions and working pressures from proposed standard CS-159-160 for Type III (high-density Resin). [b] Pipe based on prescribed I.D. and pressure rating of CS 197-60. [c] Pipe based on prescribed I.D. and O.D. of CS 197-60 or IPS. [d] Not in standards. [e] Not applicable. [f] Working pressure of oriented pipe made to corresponding standard dimension shown for unoriented pipe. [g] Minimum dimensions of oriented pipe required to withstand 100 p.s.i., wall thickness calculated using 1200 p.s.i. hoop stress in Barlow Formula.

COUPLINGS FOR PIPE STRENGTHENED BY BIAXIAL ORIENTATION

TYPE I



A. Polyethylene pipe
B. External collar pushed over pipe
C. Internal bushing
D. External collar before pushing on pipe
E. Rings for easy drawing-up collars

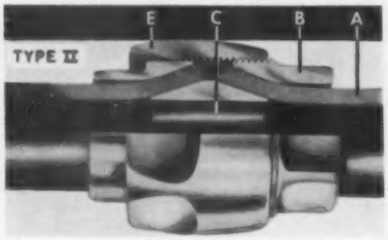


FIG. 7: Two types of friction pipe couplings suitable for use with unthreaded, biaxially oriented high-density polyethylene pipe.

long-term tests and excessive elongation of the pipe's dimensions was still a problem (2).

It was found desirable, in order to reduce the elongation that took place during the long-time creep tests, to orient the pipe equally both axially and radially, (5) within limits shown in Figs. 1 and 2. A suitable equipment set-up for this process is shown in Fig. 4, p. 112.

Here an extruder makes pipe with an initially oversized wall thickness. This is sized by internal air pressure in an outside sizing die, and cooled to about 120° C. The pipe then passes directly through a special heating bath, details of which are shown in Fig. 5, p. 113. The pipe, *1*, passes through a flexible sealing ring, *2* (nitrile rubber or fluorocarbon), into the heating bath, *3*, being guided by the oversize metal pipe, *4*. The space, *5*, between the plastic pipe, *1*, and the guide tube, *4*, is filled with the bath heating medium, ethylene glycol, which is held under pressure provided by the pump. The glycol is maintained at a carefully controlled temperature. The inside wall of the guide tube, *4*, is provided with spiral brass fins to impart turbulence to the liquid in the space, 5. The pipe, uniformly heated to the orienting temperature, leaves the heating bath thru sealing ring, 6, and the internal pressure immediately expands it against the cooling ring, 7, which is held at 20 to 25° C. The end of the emergent pipe is plugged and the product is wound on to a drum.

The length of the heating bath is determined by the pipe's wall thickness, its rate of travel, and the temperature of the incoming pipe. To expand smoothly without bubbles or blowouts upon orientation, the pipe must be heated uniformly and thoroughly and held at the orienting temperature to within 1° C. (2° F.).

In a test run of a heater 36 ft. long, cold pipe of 1.26-in. diameter and 0.260 ± 0.040-in. wall thickness was fed to the heating bath which was operated at 125 ± 0.5° C. at a rate of 14 in./min. The glycol in space, 5, was kept at a pressure of 28.5 p.s.i.g., and there was 42.7 p.s.i.g. of air pressure inside the pipe. A strengthened pipe, 1.77 in. in outside diameter, 0.087 in. thick was made at a rate of 20 in./min. This corresponds to a heating rate of 3 min. per 40 mils of wall thickness of pipe fed in. In this trial, the material was stretched at 1.7:1 ratio simultaneously in both axial and circumferential directions.

The material used in these trials was similar to Hi-fax[2] 1700 black high-density PE; a grade normally used for unoriented pipe meeting the requirements of U. S. Department of Commerce Commercial Standard CS 197-60 Type III. Biaxial orientation improves both circumferential strength, or pipe hoop stress, and strength in the direction of the pipe axis.

In general, the stretch ratio above will produce pipe showing the long-time creep behavior depicted in Fig. 6, p. 113. The pipe, prior to orientation, should have a wall thickness about three times that of the final oriented pipe.

The O.D. of the pipe to be biaxially oriented to a specified final outside diameter D_f and wall thickness t_f follows the relation:

$$D_s = (D_f - t_f)\,(V_l/V_t) - t_f\,V_t \quad \text{Eq. 2}$$

Where V_l is the stretch ratio lengthwise and V_t is the wall stretch ratio; that is, the product of V_l times the stretch ratio in the circumferential direction. In the test run described above D_f is 1.77 in., t_f is 0.087, V_l is 1.7, $V_t = 2.89$, and using Eq. 2, D_s becomes 1.24 inches.

Wall thickness t_s of the starting pipe is then calculated from the relation:

$$2\,t_s = D_s - [\,D_s^2 - 4\,V_l\,t_f\,(D_f - t_f)\,]^{\frac{1}{2}} \quad \text{Eq. 3}$$

Using the above values, $t_s = 0.25$ inch. The calculated values are, therefore, within the limits of pipe sizes used.

In production, the heating bath could be coupled directly to the extruder, pipe entering at temperatures of 100 to 120° C. (212 to 248° F.). From curves of enthalpy (heat content) vs. temperature for high-density polyethylene (3) it can be shown that the heating bath input required would be smaller for the hot pipe feed than for cold pipe entering at 20° C. (68° F.).

Offsetting this somewhat is the fact that the temperature difference between the heating bath and the warm pipe is smaller, hence heating would take place more slowly.

In a commercial unit now operating as described, speeds of over 4 ft./min. have been experienced in the production of biaxially oriented pipe with outside diameter ranging from 1 to 4 inches.

Data in Fig. 6 show the results of long-term pressure tests (5) upon this pipe compared with unoriented pipe made from the same resin, and illustrates the significant improvement in long term strength due to simultaneous orientation in two directions.

At any time shown on the curve for normal unoriented pipe at 20° C., the corresponding stress which causes rup- **(To page 212)**

[2]Trademark of Hercules Powder Co.

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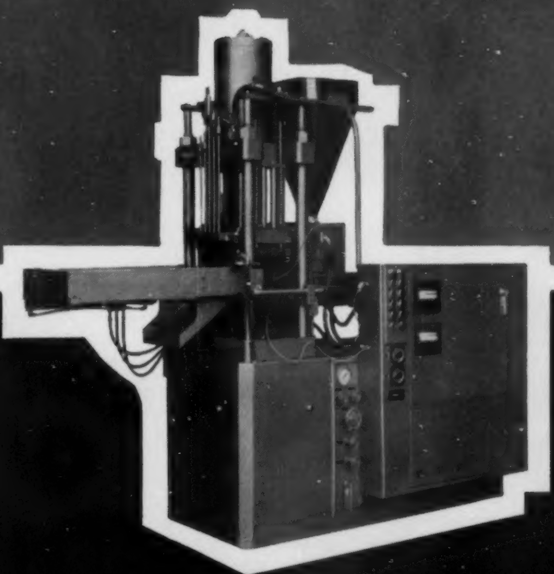

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How molding conditions affect polypropylene

Indications are that wide variations in machine conditions have little effect on properties

By Howard Robb*

A basic consideration in molding any thermoplastic is the effect of the machine conditions on polymer properties, especially those which affect the toughness and appearance of the molded item. To obtain such information, which would apply to a wide range of machines, test conditions were chosen which would provide the most universal results.

Stock temperature effects

To obtain stock temperature effects on the properties of the molded items, standard ASTM test bar samples were molded on a 4-oz. Reed-Prentice at various temperatures. All bars were end gated and all properties with the exception of Izod impact were measured parallel to the direction of flow. Izod impact was measured across the flow.

The above-named machine was chosen because cylinder retention time was about 15 min., which was felt would represent more severe thermal exposure than the average met in actual practice. Also, using this inventory time of 15 min. the temperature of the melt is almost identical to that of the heater settings. Thus, in the following discussion the remarks on properties will be related to the actual stock temperature and will refer to material which has been exposed to the higher temperature longer than in the average shop. At each temperature, the pressure used was the maximum allowable without flashing the mold. Cycle time was maintained constant, so the variables become the polymer properties as a function of temperature.

Since the molecular weight distribution and isotacticity of polypropylene will also affect the toughness of the molded item, a high isotactic material, a low isotactic material, and a high isotactic material of wide molecular weight distribution were run at each temperature. Thus, the effects of temperature on the various levels of isotacticity and the effect of temperature on high isotactic material with different molecular weight distribution, were obtained.

Tensile strength

Figure 1, right, is a plot of tensile strength as a function of heater or stock temperature. Polymer A is a high isotactic, wide molecular weight distribution polypropylene; Polymer B is highly isotactic and has a relatively narrow molecular weight distribution; and Polymer C is a low isotactic material with a distribution similar to *B*. It is apparent that the degree of isotacticity has an appreciable effect on tensile strength; however, the molecular weight distribution has a negligible effect since materials *A* and *B* follow practically the same curve. The variation of strength with temperature is the same for all three polymers, with all exhibiting practically no drop-off in tensile strength in going from 450 to 650°F. Even at 650°F. there is no appreciable loss in tensile strength.

It was concluded that the tensile strength of polypropylene is not appreciably affected by the heater setting of the machine. Also, the degree of isotacticity or the molecular weight distribution appear to have no effect on this response to temperature since all three materials show no appreciable drop-off in tensile strength at 650°F.

The general effect of changing mold temperature is also the same regardless of the heater setting. For the three curves shown in

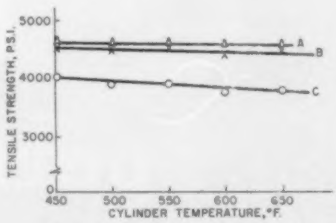

FIG. 1: Tensile strength as a function of cylinder or stock temperature for three different polypropylenes, **A:** high isotactic polymer content with broad molecular weight distribution; **B:** high isotactic polymer content with narrow molecular weight distribution; and **C:** low isotactic content with narrow molecular weight distribution similar to B. Tensile strength measured parallel to mold flow lines.

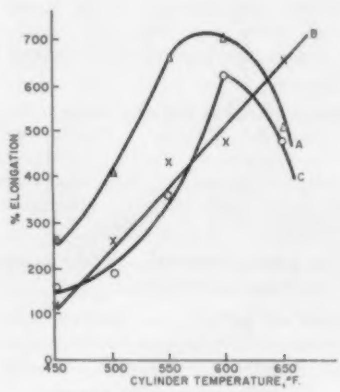

FIG. 2: Tensile elongation as a function of cylinder or stock temperature for the three polypropylenes described in Fig. 1, above.

*Staff member, Spencer Chemical Co., Kansas City, Mo.

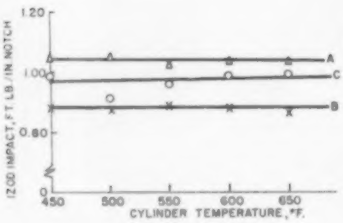

FIG. 3: Izod impact as a function of cylinder or stock temperature for the three polypropylenes described in Fig. 1. Impact strength measured perpendicular to direction of mold flow lines.

Fig. 1 the mold temperature employed was 130°F. When the mold temperature was raised to about 190°F. the tensile strength at each heater setting increased very slightly. This is due to the fact that a hotter mold permits a greater degree of crystallization, which, in turn, results in a higher tensile strength. The colder the mold, the less the crystallization, and the lower the tensile strength.

However, it should be emphasized that changing mold temperature from 60 to 190°F. has only a very slight effect on the tensile strength (less than ± 5%). This is not to say, however, that under conditions of extreme orientation, particularly in gate areas, mold temperature would not be an important factor. Here we are speaking in terms of only the average tensile strength as such.

In summary, the effect of both cylinder and mold temperature on tensile strength is very slight regardless of the degree of isotacticity or molecular weight distribution. It is possible to impose other molding conditions under which this generalization would not hold. For example, if a molder shortens the cycle to an extent that the residence time of the material in the heating cylinder and its stock temperature are significantly reduced, the issuing melt may not be fully plasticated. However, in the range of temperatures studied and with well plasticated melt, these conclusions appear to be valid.

Tensile elongation

Figure 2, p. 116, shows the effect of heater settings on the tensile elongation of the materials. Again Polypropylene A is highly isotactic, and has a relatively wide molecular weight distribution. Material B is highly isotactic and has a narrow molecular weight distribution; and Material C is a low isotactic material. A striking feature of these results is that the tensile elongation increases rapidly and by a large amount with increases in cylinder or stock temperature up to about 575°F. For all three polymers an increase of 50°F. in temperature results in an additional 100% elongation, or more. Elongation was found to continue this increase to approximately 575 to 600°F. and then to decrease. However, the decrease, even at 650°F., does not lower the elongation to the original value; the elongation is still at least double what it was at 450°F. This is most unusual for any of the thermoplastics.

The tentative explanation is that, with increasing temperature, a very small percentage of lower molecular weight fragments are generated. These lower molecular weight fragments appear to plasticize the material and increase the ability of the material to elongate and cold flow. The reason that the gain in elongation levels off at 600°F. is the fact that the heat stabilizers in the material begin to give way rapidly, producing gross thermal degradation which accounts for severe loss in elongation. Two opposing mechanisms are at work here. The first being the generation of small fragments which plasticize the material; this requires only a very small amount of low molecular weight material. The second appears to be gross thermal degradation of the material, which reduces the tensile elongation. Unlike other thermoplastics, the percentage elongation is still far above the 450°F. percentage elongation even at 650°F.

The same general trend is observed with all three materials, regardless of the degree of isotacticity. Note also that the rate of increase is about the same for all three materials. By comparing the curve for Material A with the other curves, a higher initial percentage elongation is observed for the wider molecular weight distribution Polypropylene A than for either of the two materials which have narrower and about equal molecular weight distributions. It also appears that polypropylene with broad molecular weight distributions will consistently exhibit higher elongation than those with narrow distributions over a broad range of molding temperature.

Another point is the fact that Materials B and C exhibit about the same amount of elongation although they have differences in degree of isotacticity. Further, the effect of molecular weight distribution or isotacticity on the point at which degradation or fall-off in elongation begins is also apparently negligible.

Also, since the amount of elongation appears to depend more on molecular weight distribution at this molecular weight level than on isotacticity it would be expected that the narrow molecular weight distribution polymers would peak at somewhat slightly higher temperature but at approximately the same percentage elongation. That is, there is a limit to the amount of elongation that polypropylene will exhibit, regardless of molecular weight distribution or molding temperatures.

In general, unless one goes to extremes, it was found that the effect of mold temperature within the range studied (60 to 190°F.) on elongation is negligible.

Impact strength

Figure 3, above, shows the variation of Izod impact strength with cylinder or stock temperature. Again, materials designated *A*, *B*, and *C* are as before. The low isotactic material, *C*, as would be expected, has a higher Izod impact value than the higher isotactic, *B*.

This is attributed to the differences in the degree of crystallinity and is the same general trend found with other crystalline polymers, namely, the higher the degree of crystallinity the higher the tensile strength but the lower the impact strength.

Polypropylene A has a very interesting Izod impact-cylinder temperature profile in that it has a higher impact than the narrow molecular-weight, low-isotactic Material C, and a higher impact profile than that of **(To page 122)**

NEW FROM EASTMAN

TENITE Polyethylene is now available in formulations containing a new ultraviolet inhibitor that gives them superior resistance to sunlight and weathering

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- The new inhibitor markedly extends the useful life of polyethylene film for greenhouse glazing...silo, storage and machinery covers

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New, specially stabilized Tenite Polyethylene formulations for extrusion into thin, transparent, weather-resistant film are now available from Eastman. Incorporated in the resins is a new non-pigment ultraviolet inhibitor developed by Eastman chemists.

The effectiveness of the inhibitor is not impaired by molding or extrusion temperatures as high as 600°F. This, too, represents an improvement over polyethylene formulations stabilized with previously available ultraviolet inhibitors.

Film only 5 mils thick, extruded from a typical Tenite Polyethylene formulation containing the new inhibitor, has withstood two years of continuous outdoor weathering with little loss of strength. Results of tests on the exposed film show that it retained more of its original properties after 24 months' exposure than film of unstabilized polyethylene retained after only 12 months' exposure.

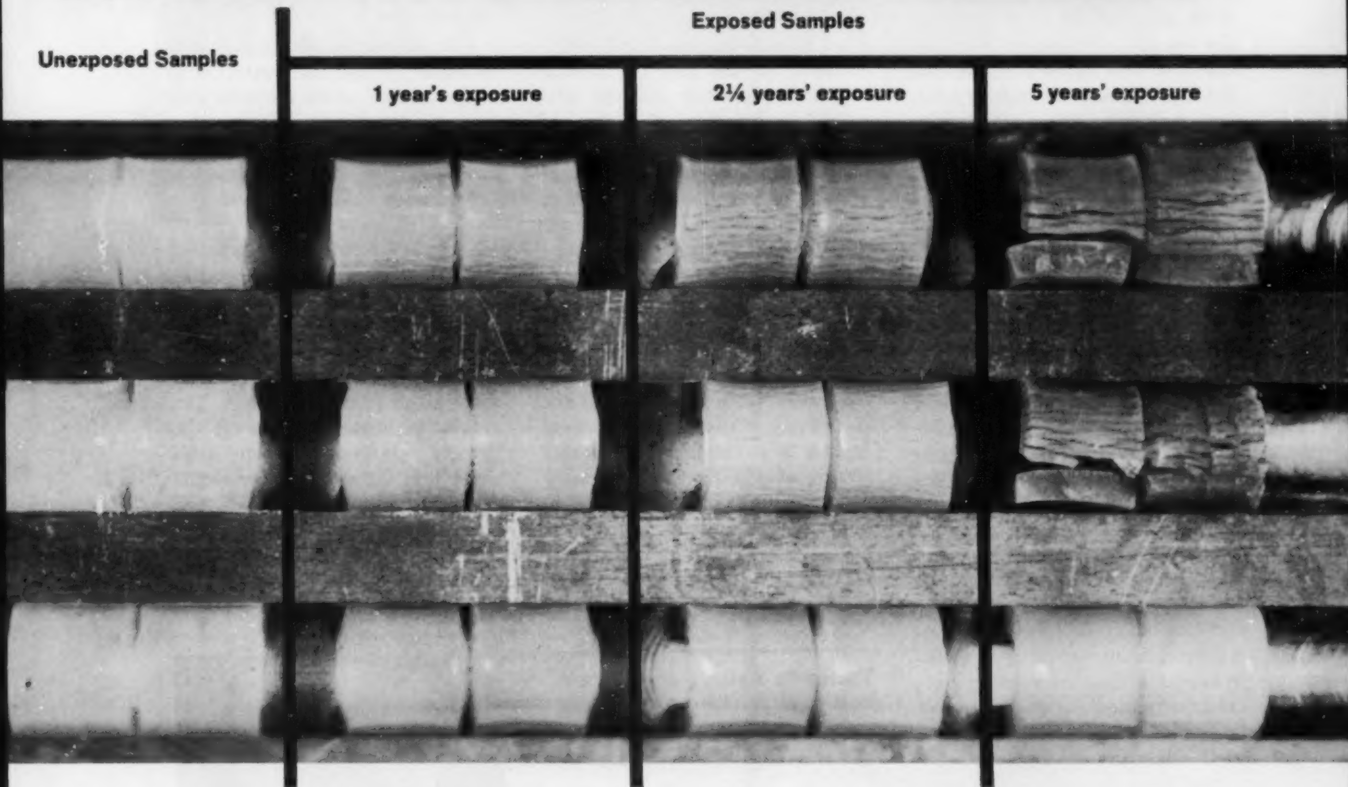
Specifically, the stabilized film retained a high degree of original clarity, and remained smooth, pliable and tough.

The demonstrated superior performance of the new stabilized resins greatly extends the usefulness of polyethylene film in such outdoor applications as glazing for greenhouses, and protective covers for silage, machinery and other outdoor-stored materials.

Eastman also supplies a stabilized Tenite Polyethylene formulation for extrusion of sheet 50 mils or thicker as well as for injection molding of heavier sections. In weathering tests recently completed, 50-mil sheet of this material retained 88% of initial elongation after three years of outdoor exposure. Heavier sections (125 mils), weathered under stress, still retained their good appearance after five years. Such results indicate that polyethylene sheet and molded parts can be expected to resist the elements two to three times as long as was previously possible.

For further information on Tenite Polyethylene formulations stabilized with the new ultraviolet inhibitor, contact any of the Tenite sales offices, or write EASTMAN CHEMICAL PRODUCTS, INC., subsidiary of Eastman Kodak Company, KINGSPORT, TENNESSEE.

WEATHERABILITY OF STRESSED TENITE POLYETHYLENE



Pictures are better than words!

Here is an unretouched photograph showing a test rack of stressed molded specimens after 5 years of continuous exposure in Tennessee. Specimens were 125 mils thick and were molded from a typical base formulation of Tenite Polyethylene. The photograph forcefully illustrates the effectiveness of Eastman's new ultraviolet stabilizer.

TENITE® POLYETHYLENE
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the high-isotactic, narrow molecular-weight distribution, Material B. This is in line with what has been found with respect to increasing elongation with wider molecular weight distribution.

It has been discovered that the toughness for any given material usually varies as the product of the tensile strength and elongation. Thus, since in this case the tensile strength is fairly constant regardless of the molecular weight distribution, and the percentage elongation increases with the molecular weight distribution, it is only natural that the Izod impact value would also increase with increasing molecular weight distribution.

Thus, by increasing the width of the molecular weight distribution of the high-isotactic material one can obtain the toughness that is characteristic of the low-isotactic material. At the same time, one can retain the tensile strength, hardness and flexural stiffness of the high-isotactic or high-crystalline material. The variation in impact strength with stock temperature for all three materials is essentially identical in that none shows any appreciable or significant change in the range of 450 to 650°F. As with tensile strength, the toughness of polypropylene appears to be unimpaired over a considerable range of molding conditions. This indicates that polypropylene gives the molder greater freedom to change molding conditions without damaging the part's toughness than is commonly found with many other polymers. However, this does not imply that such problems as gate brittleness, loss of properties through degradation, or other common molding problems can not be encountered with polypropylene; merely that there is generally a greater degree of molding latitude with polypropylene than with other thermoplastics.

The Izod impact values were obtained on samples made with the mold at 130°F. Increasing the mold temperature from 130 to 190°F. has a negligible effect on the Izod impact value which is consistent with the results upon the other properties. Thus, Izod impact is relatively insensitive to any changes in the molding conditions, as compared to the other thermoplastics.

Since it is well known that the actual toughness of the molded part does not always correlate with test specimen values for Izod impact, elongation, or tensile strength, a further evaluation was made in which tumblers (Fig. 4, below) were molded at various cylinder temperatures and subjected to the ball-drop impact test. The ball-drop test involved dropping the ball on the bottom of the cup, which was sprue gated in the center of the bottom. Cracking patterns were too randomized to indicate orientation, due to the absence of any significant trend in the cracking pattern. As before, a constant cycle time and maximum pressure consistent without flashing were used. An attempt was made also to maintain material retention time in the cylinder at 15 min., as was used in molding the test bars.

Based on the test bar results one might conclude that the optimum combination of cycle and molded part quality would be obtained at the higher heater settings. As indicated in Table I, below, this was not the case; the maximum ball-drop impact resistance was obtained at about 500°F., not at 600°F.

However, the trend observed in the ball-drop impact resistance was generally the same as in the elongation results for test bars. A low value of ball-drop impact resistance is obtained at a heater setting of 400°F.; a considerably higher value is obtained at 500°F. and a decrease is obtained at a heater setting of 600°F. But the maximum value was not obtained at the same temperature as that on the elongation test bar. The indication is that the relationships between physical properties and molding conditions obtained on a test bar mold are not exactly translatable to molds for other parts. Obviously, changes in the geometry of the part will affect the final properties of the part as much as other molding machine settings or parameters. But the results on the test bar are useful in establishing patterns of molding behavior.

For this tumbler mold it would appear that the optimum fabrication temperature would be in a stock temperature range of approximately 500 to 525°F. The effects of going up to a stock temperature of 600°F. are quite pronounced and follow the same trends as the test bars.

Orientation

The normal question arises as to whether or not the variation in the toughness of the material with heater settings was due to orientation. The density of cuttings from samples molded at various temperatures was measured in a density gradient column.

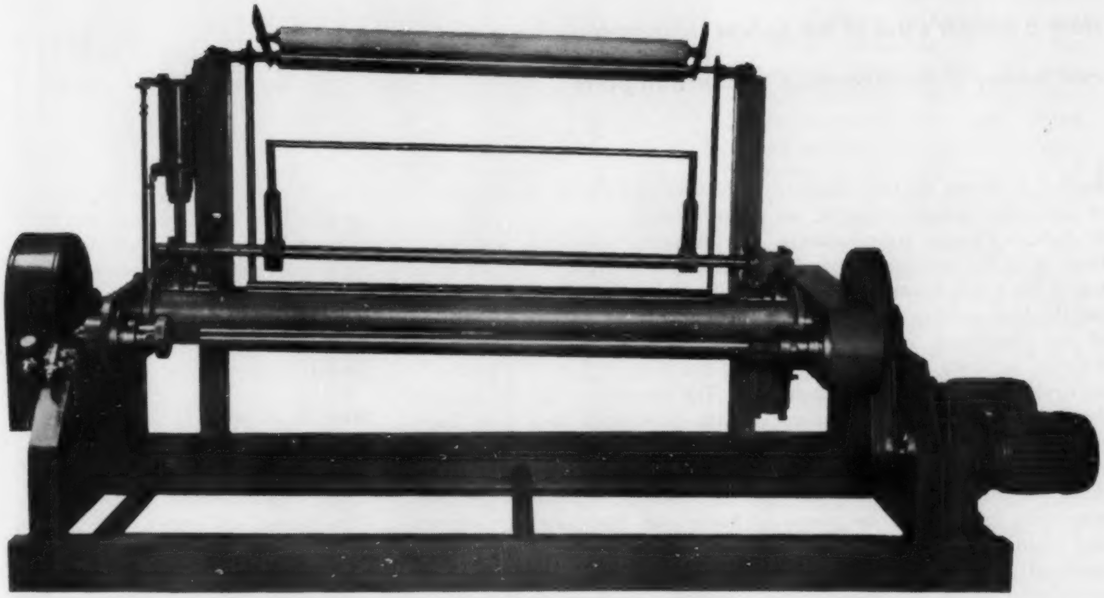
It would normally be expected that any change in orientation which would produce such a drastic change in the properties would produce at least a measurable effect on the density of the material in the molded item. The results of measurements in the density gradient column indicated that the density of the cuttings from all the materials, and from the same spot on each object, were identical. If density is an adequate measure **(To page 218)**

Table I: Ball drop impact vs. heater settings

Heater settings	*Ball drop*
°F.	*in.*
400	9
500	24
600	15

Note: 1) Testing temperature, 73°F. 2) Drop height is inches required for 12-lb. ball to produce at least one break out of five specimens but not breaks in all specimens.

FIG. 4: Tumbler used in ball-drop impact tests. Part was center gated in the bottom and ball was dropped in this area.



Optical gaging—a valuable tool

How a molder's use of the optical comparator saves time and money in the inspection of precision parts

By Joseph D. Portello*

Like so many custom molders of precision industrial parts, we at Auburn Plastics are constantly faced with the problem of working to close tolerances and meeting the high quality requirements of our customers. In such work a highly accurate system of quality control and inspection is mandatory to avoid the shipment of defective parts resulting in costly rejects and customer returns. As the needs for increased inspection grew with our precision molding business, it became apparent that the limitations of mechanical gages and measuring devices were creating a number of inspection problems as the complexity and quantity of our parts increased.

In our investigation to find a quicker and more accurate inspection tool we decided to install an optical comparator to be used for measuring variables in our products.

To our knowledge, we were first in the plastics industry to use such an instrument in a custom molding operation. As we made increasing use of the optical comparator we have become convinced of the value of this instrument to the custom molder. Its use has reduced our manufacturing costs, reduced our rejects and generally aided our entire custom molding operation.

What is it?

For those readers who are not familiar with the optical comparator a brief description is in order. In short, it is nothing more than a specially modified picture projector similar to a home slide viewer. A cutaway of the projector is shown in Fig. 1, right. Instead of using a transparency, the surface of the part or a shadow of the outline of the part is projected through a calibrated lens system onto a ground-glass viewing screen.

Several calibrated lens systems can be employed which magnify and reproduce the image on the screen in an exact and proportionate ratio to the actual size of the part.

The screen is usually marked with gage lines and cross hairs and the entire screen can be rotated within a calibrated ring (protractor) to position the cross hairs and lines at any desired angle with the vertical. Interchangeable screen faces with various gage markings can also be used, as shown in Fig. 1.

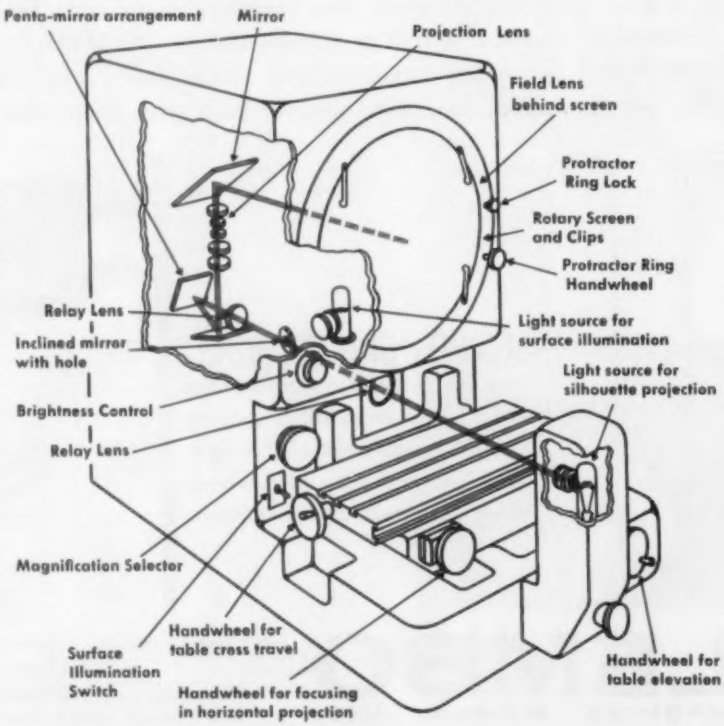
The instrument is also provided with a precision movable table which can move vertically or laterally and from front to back by a small amount for focussing purposes. The table is moved by vernier handwheels calibrated in inches. As can also be seen in Fig. 1, light sources are so placed that either the surface of the part or a silhouette of the part can be projected on the screen.

How it is used

The comparator can be used in two basic ways; first, for the direct measurement of linear dimensions and angles; and second, for the comparison of part configurations and dimensions with calibrated gage charts and marks.

Direct measurement of a linear dimension is illustrated in Fig. 2, right. A flat part is mounted on the movable table perpendicular

FIG. 1: Schematic cut-away view of the optical comparator showing lens system, movable table, and viewing screen. Part is placed in path of colored light beam.



*Quality control supervisor, Auburn Plastics Inc., Auburn, N. Y.

OPTICAL COMPARATOR is being used to check concentricity and center location of hole in molded plastic part. Note that center of hole is not on part itself and would be difficult to accurately locate for measurement of radii with mechanical tools.

to the light rays and focussed. One end of the image of the dimension to be measured is then moved on the screen (by moving the movable table with the part) to coincide with the vertical cross hair on the screen as shown in Fig. 2a. The reading on the calibrated table handwheel is then noted. Next the table is moved so the image of the other dimension limit coincides with the vertical reference line on the screen. (See Fig. 2b.) The handwheel is read again and the difference between the final and initial reading is the distance between the two points on the part.

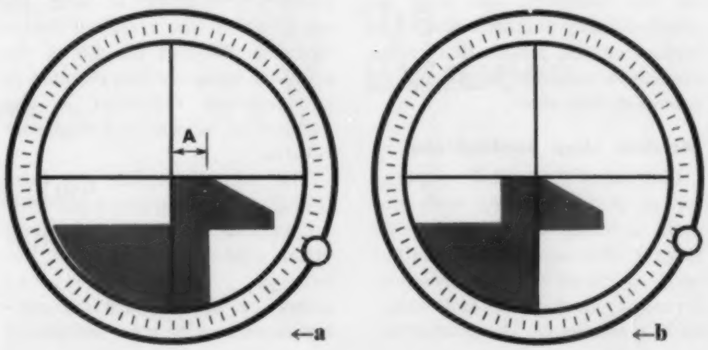
On some parts a linear dimension such as this could have been read with a micrometer. However, note that the application of a micrometer to the particular part dimension shown in Fig. 2 would have been difficult because of the sloping end of the dimension at the right. With the optical comparator this sloping edge presented no problem. In addition, the magnification of the comparator allowed a more precise measurement of the part as well as presenting a large area for viewing which also shows up irregularities, burrs, or other defects that may affect the part dimension. By using the proper lens system, such direct linear measurements can be made with an accuracy of ± 0.0001 inch.

Fig. 3, p. 126, illustrates the direct measurement of an angle. Here the cross hairs are first indexed on the horizontal dimension as shown in Fig. 3a and the outside protractor rim of the screen is indexed. Next the cross hairs and screen are rotated to index on the inclined side of the part as shown in Fig. 3b. The protractor around the periphery of the screen is then read to obtain the included angle between the initial and final reading of the screen adjustment. By adjusting the position of the movable table to properly position the part on the screen, all angles on the part can be quickly and accurately checked without any readjustment of the part-holding fixtures.

The complete inspection of all part dimensions can be done simultaneously by the second technique used with the comparator. In this technique, the image of the part dimensions to be inspected is compared with various gage charts which can be interchangeably mounted on the face of the screen. An illustration of this technique is shown in Fig. 4, p. 126. Here the teeth of a molded gear are checked for tolerance agreement against a gage chart specifically prepared for this gear. The gage chart of the gear shows two outlines of the gear teeth; one outline defining the maximum limit; the other outline, the minimum limit.

Note that all gear teeth are checked, and checked simultaneously as well as rapidly. With the proper statistical sampling technique, a lot of molded gears can

FIG. 2: Two diagrammatic views of comparator screen showing method of measuring linear dimension with comparator: a) part dimension image is indexed on screen by adjusting movable table; b) other end of dimension image is moved onto vertical cross line by movable table. Dimension is difference between readings. Dimension A is being measured below.



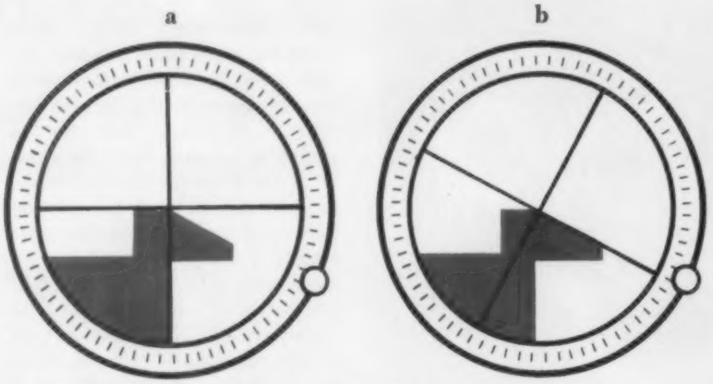


FIG. 3: Measuring an angle using the optical comparator: a) cross hairs are positioned at angle's apex with horizontal cross hair coincident with one side of angle; b) screen is rotated to place horizontal cross hair coincident with other side of angle. Difference in readings on protractor periphery of screen is included angle.

be checked for conformance quickly and without the use of special gages. Note also that, in addition to indicating in and out tolerance of teeth on the gear, the image also displays the character and amount of the deviation as well as other irregularities.

The gage charts are made to an exact, appropriate scale and are as easy to prepare as the original blueprints for the part. One big advantage of using these charts is that duplicates are easily and accurately made photographically from a single master tracing. Thus, when a gage chart shows wear, a perfect, exact copy can be made for further use. This is not as readily done with mechanical gages, which will vary slightly from gage to gage because they must each be machined separately working from a drawing to gage maker's tolerances.

Using the gage tool charts, inside diameter of holes can be checked for concentricity with outside diameters and dimensions measured from reference points on the blueprint can also be checked easily and accurately. Interference and proper fit of subassemblies can also be checked on precision tool chart.

Molding shop applications

Our use of the optical comparator at Auburn starts with the mold to make the parts. In this respect, the comparator is often used to check die conformance, threaded core pins, and other mold components. As production jobs go into the mold sampling phase, we use the comparator to check and correlate the differences between mold and the plastic castings produced from the mold under variable operating conditions. The optical comparator is especially useful here when irregularities in shrinkage are evident due to varying thickness of the part. At this mold sampling stage the information from the comparator is valuable in indicating what mold changes are necessary to bring the molding into agreement with the part requirements. In addition, the image produced on the comparator screen can be photographed and we can send duplicate photos of our preliminary parts inspection results to the customer and all other interested parties for comments and acceptance.

After a part, which requires strict quality control, goes into production, a statistical sampling technique in combination with the use of gage charts in the comparator is used to check the current production to keep the parts within the required specifications. We feel the use of the optical comparator has resulted in a significant reduction in the number of rejects and customer returns.

The comparator has also been useful in checking parts and tools for various auxiliary operations in our custom molding plant. For example, hot-stamp printing plates are checked for design conformance and proper location of letters and decorations by means of the surface-viewing feature of the comparator.

How much saved?

All variables considered, it is practically impossible to tell exactly how much we save in dollars and cents by the use of optical gaging in comparison to other inspection methods. Our company produces a wide variety of component parts for various manufacturers by compression, transfer, injection, extrusion, and rotary molding. Formerly many mechanical gages were needed to make necessary quality control checks. Our optical projector has eliminated the expense of buying such gages—amounting in one instance to a savings of $5000. We feel we can submit lower bids because of savings permitted by optical gaging. These savings are realized by considering many factors.

Time, including set-up time, is a very important factor in inspection cost. Inspection time is determined by number and nature of dimensions checked. On a simple part where there is little set-up, and few dimensions to be checked, optical gaging is only a little faster than mechanical gaging. But as complexity of the part grows we find optical gaging coming out well ahead, because once a part is staged in position on a projector it often need not be rehandled and all necessary dimensions can be read at a glance on a screen. In contrast, mechanical inspec- **(To page 223)**

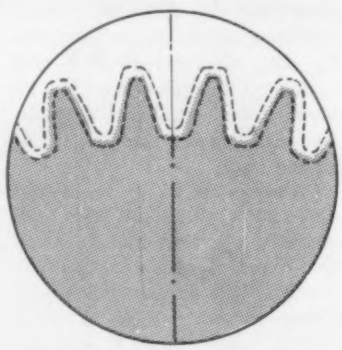
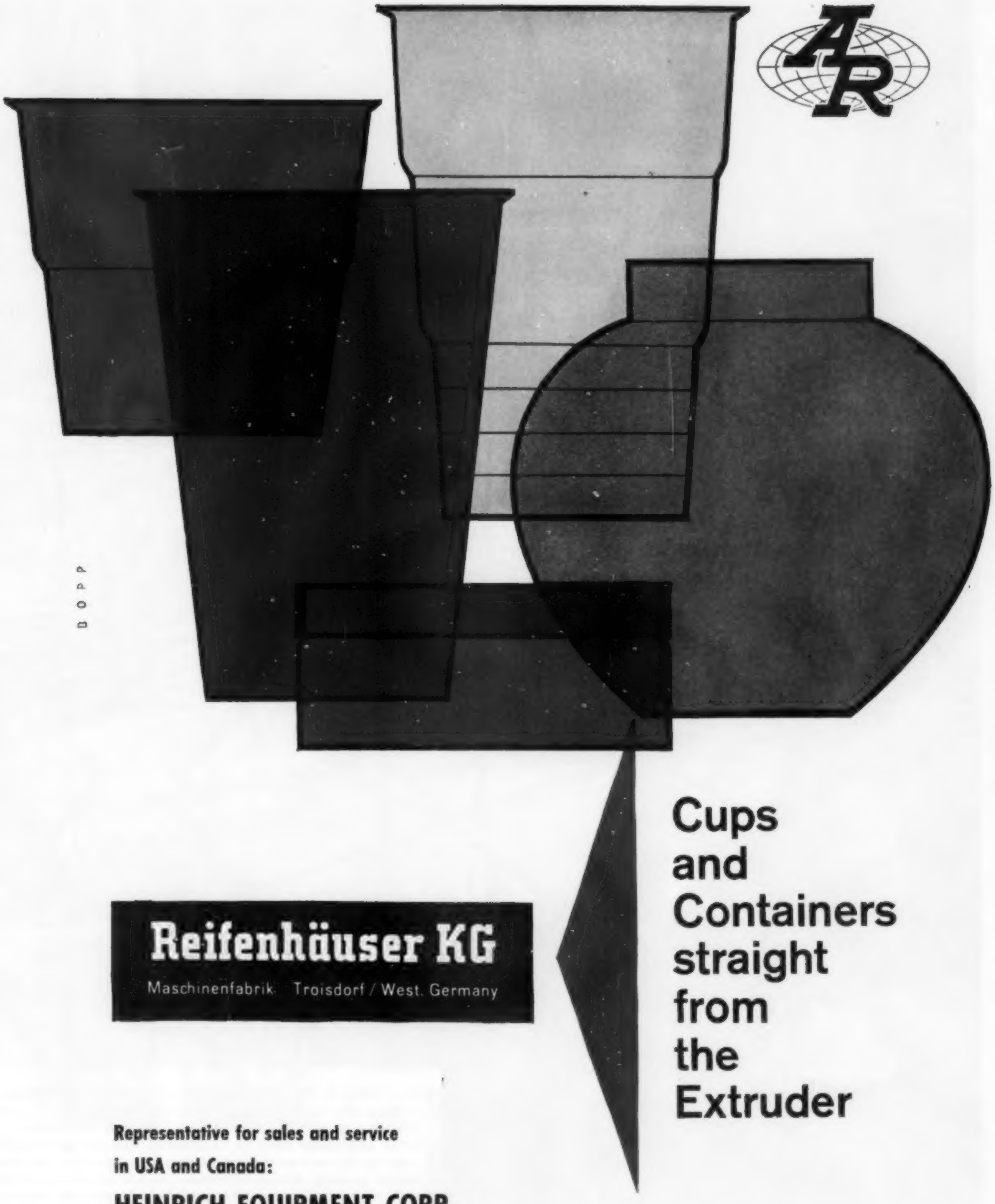


FIG. 4: Illustration of the use of gage chart in checking gear teeth configurations and tolerances. Dotted lines on chart show allowable minimum and maximum dimensions of gear teeth.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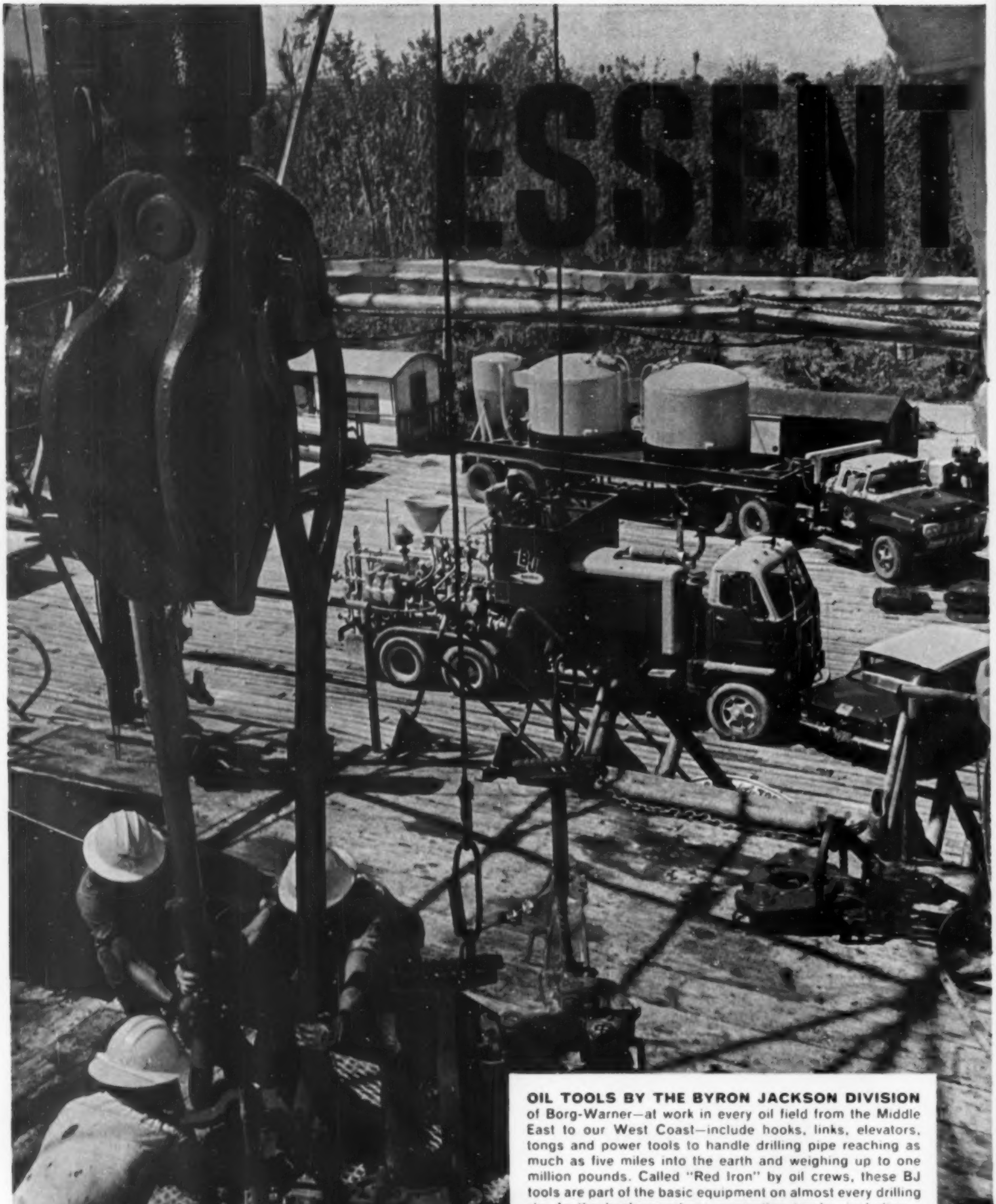


OIL TOOLS BY THE BYRON JACKSON DIVISION of Borg-Warner—at work in every oil field from the Middle East to our West Coast—include hooks, links, elevators, tongs and power tools to handle drilling pipe reaching as much as five miles into the earth and weighing up to one million pounds. Called "Red Iron" by oil crews, these BJ tools are part of the basic equipment on almost every drilling rig. In the background are cementing trucks, including a high-pressure pumping truck and special bulk cement unit—members of the familiar blue-and-yellow fleet of BJ Service that provides technical field services.

IALS

BY BORG-WARNER

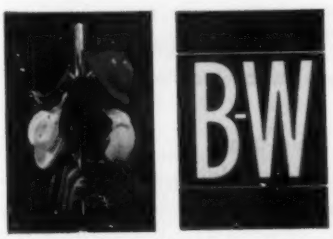
Among the 7 Hats of Borg-Warner —a helmet to symbolize our contributions to the oil, steel and chemical industries

Without the tools and techniques of man, our country's huge reservoir of oil would remain untapped today. How valuable would a deposit of iron ore be without men and machines to make steel? Not even Nature herself can equal the qualities of such modern synthetic materials as plastics.

Partner to the growth and progress in oil, steel and chemicals are many of the divisions and subsidiary companies of Borg-Warner Corporation. B-W's Byron Jackson Division, for example, has long been the pacemaker in special tools required to drill oil wells which must probe miles below the earth's surface. BJ Service crews and equipment provide the cementing and treating techniques which keep these wells healthfully productive . . . and BJ centrifugal pumps supply the pulsing power for pipelines, refinery, chemical and metal-making processes.

Three B-W divisions—Ingersoll Steel, Calumet Steel and Franklin Steel—produce such quality specialty steels as stainless, alloy, tool and saw steels and bar mill products. Marbon Chemical Division is responsible for the creation of Cycolac®, the Borg-Warner plastic whose balance of properties make it truly unique, along with reinforcing resins and rubber-to-metal adhesives for the rubber industry and synthetic resins for the paint industry.

The years ahead promise a growing need for oil, steel and chemicals—and promise, too, even greater service to these industries by Borg-Warner.



The 7 Hats of Borg-Warner . . . (top) national defense; oil, steel and chemicals; (middle row) agriculture; industrial machinery; aviation; (bottom) the automotive industry; home equipment.

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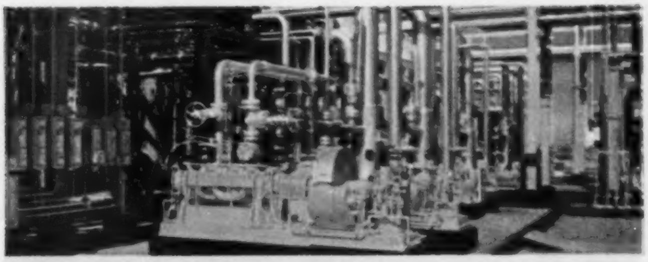


PUMPS BUILT BY BYRON JACKSON are equally at home handling hot oil at 800° refinery temperatures (as shown above) or in feeding low-temperature liquid oxygen (−320° F.) to a modern steel furnace. Serving almost every phase of the oil, steel and chemical industries, BJ pumps transport essential fluids . . . provide water under pressure for cleaning, cooling and secondary oil recovery . . . push petroleum products through thousands of miles of pipeline "arteries."

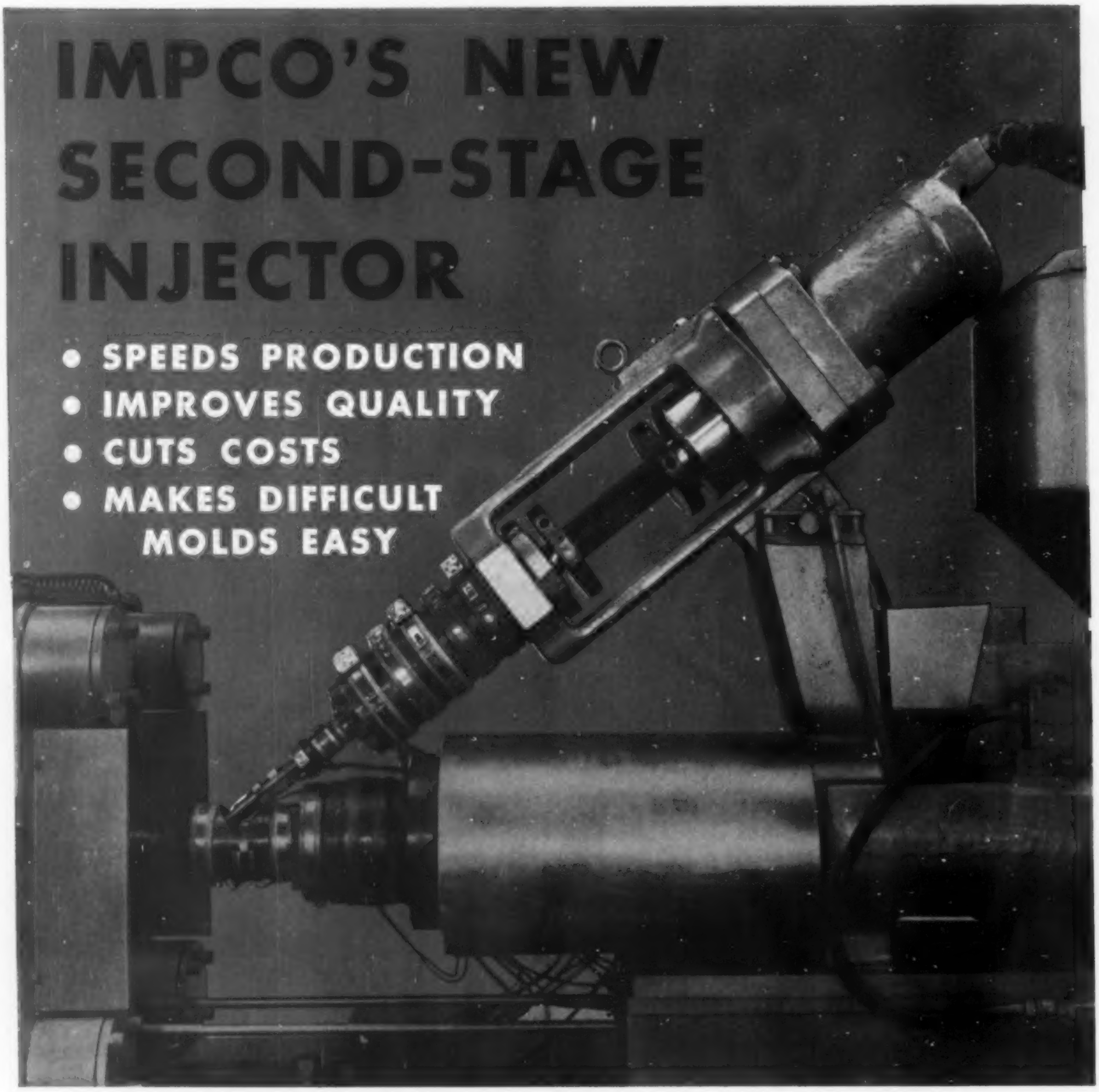
STAINLESS STEEL, solid and clad —processed for exceptional forming abilities—is just one of the steels made by Ingersoll Steel. A modern specialty mill, Ingersoll is geared to meet customers' analysis, size, gauge, finish "specs"—exactly, economically.

STEEL BARS AND SHAPES rolled by Calumet and Franklin Steel Divisions meet exacting specifications of the construction, farm equipment, material handling and automotive industries. Other steel products: fence posts, tubing, special-use sections.

"BETTER IN MORE WAYS THAN ANY OTHER PLASTIC" sums up why hundreds of consumer and industrial products use Cycolac—the tough, hard, rigid **ABS** plastic developed and produced by B-W's Marbon Chemical Division. Familiar products easily and economically molded from colorful Cycolac pellets include (left to right) portable cooler, safety helmet, transistor radio case, portable mixer housing, telephone, typewriter housing, luggage.

WHAT BORG-WARNER MEANS TO YOU!

By making parts and materials that go into a great number and variety of finished products, Borg-Warner influences the activities of the American family. On a fall afternoon, helmets that protect football players might well be molded of Cycolac. Auto fuel that transports spectators to the site of the game is very likely refined with the help of Byron Jackson pumps. And, without a doubt, the car itself contains parts made by any one of many B-W divisions. Wherever you live, work, play or travel, Borg-Warner touches your life importantly every day.



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PLASTICS* TECHNICAL SECTION

MATERIALS • PROPERTIES • TESTING METHODS AND INSTRUMENTATION • STANDARDS • CHEMISTRY

Behavior of plastics in re-entry environments

By Donald L. Schmidt†

The unique behavior of plastics in very high temperature environments provides a simple and reliable means for the thermal shielding of hypersonic re-entry vehicles. Extreme temperatures and aerodynamic heating associated with these vehicles are accommodated with ease by a phenomenal heat and mass transfer process known as ablation.

The ablation of plastics is a complex, energy dissipative process in which surface material is degraded and removed. In this, Part I of a two-part article, important physico-chemical aspects of this process are described which show that ablative performance depends critically upon certain material and environmental variables. Part II, to be published next month, will consider the thermal parameters which indicate that ablating materials absorb and dissipate heat by several modes: mass transfer in the boundary layer, radiative transport, phase transitions, chemical reactions, convection in the liquid layer, and internal conduction and storage by the solid material.

This analysis of ablation provides a basic understanding of the behavior of plastics in severe aerothermochemical environments and guidelines useful in the selection and optimization of plastics intended for thermal protective systems of missile and satellite re-entry vehicles.

As missile nose cones and satellite vehicles re-enter the atmosphere, they encounter severe aerodynamic heating. This condition arises primarily from adiabatic compression of air molecules ahead of the vehicle and viscous dissipation of kinetic energy into thermal energy. Heat thus is continually generated in a thin "fluid boundary layer" surrounding the frontal area of the vehicle. The temperature and enthalpy (heat content) of the boundary layer may rise to very high numerical values. For example, air stagnation temperatures in the order of 9000 to 12,000° F. are encountered by present re-entry vehicles (1).[1] Similarly, the air enthalpy in the forward stagnation region of re-entry vehicles may exceed 14,000 B.t.u./lb. The highest enthalpies are associated with vehicles re-entering the atmosphere at orbital velocities. This is illustrated in Fig. 1, right, which presents several altitude-velocity trajectories for representative vehicles.

Aerodynamic heating of re-entry vehicles increases with both flight velocity and air density. Thus it is most intense when a high velocity is allowed to persist into the lower atmospheric medium. The rate of heating varies as functions of the vehicle ballistic parameter W/C_DA (see Table I, p. 132, for key to symbols), entry and flight path angles, velocity, altitude, and lift and drag forces (2). Heating is most intense in the stagnation region and at the sonic point of flow, with large variation in incident flux over the remaining external surface.

For the stagnation region of a vehicle, the heat transfer rate can be conveniently approximated by a simple correlation formula derived by Detra, Kemp, and Riddell (3). This is shown in Fig. 2, p. 133, which is a plot of stagnation point heat transfer rate from a laminar boundary layer to a vehicle of 1-ft. radius. Results are given for various flight velocities and altitudes.

During re-entry, heat is transferred from the high temperature environment to the vehicle by convection, conduction, and radiation. A portion of the incident flux is absorbed by the surface material and the remainder is

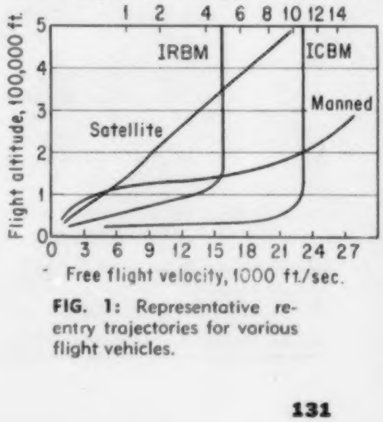

FIG. 1: Representative re-entry trajectories for various flight vehicles.

* Reg. U. S. Pat. Off.
† Nonmetallic Materials Laboratory, Materials Central, Wright Air Development Division, Air Research and Development Command, United States Air Force.
[1] Numbers in parentheses denote references at the end of the article, p. 140.

conducted into the substrate. When the aerodynamic heating becomes appreciable and the ability of the material to absorb and conduct heat internally is exceeded, the surface temperature rises quickly until pyrolysis, melting, vaporization, or sublimation occurs. As a consequence of intense re-entry heating, it is necessary to employ a thermal protective material in order to shield the vehicle structure and the internal components from hyperthermal damage.

Essentially four methods of thermal protection have been extensively investigated as means for shielding re-entry vehicles during transient hypersonic flight (4-10). These methods involve (1) solid heat sinks, (2) transpiration and film cooling, (3) radiant cooling, and (4) ablative cooling. From theoretical and experimental work conducted, it appears that each heat protective system is most efficient, on a weight basis, for specific thermal environments.

Solid heat sinks accommodate higher rates of heating, but a large mass of material is required to store the incident thermal flux and the heating rate must not exceed the ability of the material to conduct heat internally from the surface.

Transpiration and film cooling systems are very efficient for a wide range of hyperthermal environments, but they have not been used because of their inherent complexity and questionable reliability.

Radiant cooling is optimum for long time exposures, but the aerodynamic heating rate must be maintained at a relatively low value. At this time, radiation-cooled structures are limited to maximum surface temperatures of 1800° F.

Ablative cooling systems, however, have been used extensively and quite successfully to protect ballistic re-entry vehicles for transitory periods of extreme aerodynamic heating.

Plastics protective properties

Plastics as a class of ablative materials exhibit remarkable duration in transient hyperthermal environments. These materials have numerous advantages that can be used effectively in the design of thermal protective systems, namely:

1) High heat absorption and dissipation per unit mass expended, which ranges from sev-

Table I: List of symbols

Symbol	*Definition*	*Symbol*	*Definition*	*Symbol*	*Definition*
A	Frontal area, ft.²	q	Heat transfer rate, B.t.u./ft.²-sec.	b	Intact nonheated material
C_D	Drag coefficient	R	Vehicle nose radius, ft.	c	Chemical reaction
C_p	Material specific heat, B.t.u./lb.-°F.	t	Unit of time, sec.	cp	Energy storage rate in the solid body, B.t.u./ft.²-sec.
e	Exponential value	T	Temperature, °F.	cw	Cold-wall value
f	Fraction of ablated material that vaporizes	ΔT	Difference temperature (T_w–T_b), °F.	dp	Depolymerization
g	Gravitational acceleration, 32.2 ft./sec.²	u	Flight velocity, ft./sec.	f	Fusion or melting value
h	Energy absorbed or liberated, B.t.u./lb.	V_w	Velocity of surface recession, ft./sec.	g	Injected gaseous species
H	Enthalpy (heat content), B.t.u./lb.	W	Weight, lb.	i	Interface value, with mass transfer but no combustion
H_{eff}	Effective heat of ablation, B.t.u./lb.	y	Coordinate normal to the surface, ft.	L	Laminar flow
$\overline{H_{eff}}$	Thermochemical heat of ablation, B.t.u./lb.	Y	Transpiration factor	lh	Heat of physical change
ΔH	Enthalpy potential across boundry layer, with no vapor injection (H_s–H_w), B.t.u./lb.	(g)	Gas phase	o	Non-ablating value at ablative temperature
J	Joule's constant or mechanical equivalent of heat, 778.2 ft.-lb./B.t.u.	(l)	Liquid phase	r	Radiant emission rate, B.t.u./ft.²-sec.
k	Thermal conductivity, B.t.u.-ft./ft.²-sec.-°F.	(s)	Solid state	s	Stagnation point conditions
m	Mass ablative rate ($-\rho_b V_w$), lb./ft.²-sec.	α	Thermal diffusivity ($k/C_p \rho_b$), ft.²/sec.	ss	Steady-state value
M	Mean molecular weight	ε	Emissivity	st	Standard velocity, 26,000 ft./sec.
N	Transpiration number	θ	Thermal layer thickness ($-k/C_p V_w \rho_b$), ft.	T	Turbulent flow
		ρ	Density, lb./ft.³	tc	Boundary layer cooling by gaseous injection
		σ	Stefan-Boltzmann constant, 4.81×10^{-13} B.t.u./ft.²-sec. (°Rankine)⁴	w	Solid-gas or liquid-gas interface
		Υ	Transpiration factor	1	Air density at standard conditions, 0.0804 lb./ft.³
		Δ	Difference value	∞	Free stream conditions ahead of shock wave
		$\backsimeq$	Approximate value	Superscript	
		Subscripts		η	Transpiration coefficient
		a	Undissociated air		

eral hundred to several thousand B.t.u./lb. of ablative material.

2) Excellent thermal insulation, which eliminates or reduces the need for an additional internal cooling system.

3) Useful performance in a wide variety of hyperthermal environments.

4) Automatic temperature control of surface by self-regulating ablative degradation.

5) Light weight.

6) Increase in efficiency with the severity of the thermal environment.

7) Tailored performance by varying the individual material components and construction.

8) Design simplicity and ease of fabrication.

9) Low cost and non-strategic.

The inherent limitations of plastics in thermal protective systems are essentially threefold:

1) The loss of surface material and attendant dimensional changes during ablation must be predicted and incorporated into the design.

2) Service life is greatly time-dependent. Present uses are for transitory periods of several minutes or less at very high temperatures and heating.

3) Thermal efficiency and insulative value are generally lowered by combined conditions of low incident flux and long-time heating.

Ablation of plastics

The unique behavior of plastics in very high temperature environments is attributed to the automatic surface-temperature control and heat-shielding mechanism which is brought about by sacrificial loss of material. This process is commonly known as "ablation," and it occurs with the expenditure and dissipation of a vast amount of thermal energy.

The important physico-chemical aspects of ablation of plastics are illustrated in Fig. 3, p. 137, with a glass-fiber-reinforced phenolic resin serving as the ablating model.

Initially, the material acts as a heat sink. All the energy absorbed at the surface is conducted into the substrate and stored by the effective heat capacity. Heat penetration proceeds at a low rate however, due to the characteristic low thermal diffusivity of a plastic material. Consequently, the surface temperature rises rapidly until thermal degradation begins in some form. Organic components of the ablating material are depolymerized or pyrolyzed into various gaseous products, such as methane, ethylene, hydrogen, acetylene, and other hydrocarbon fragments. These species are forcibly injected into the adjacent boundary layer and continually envelop the surface in a layer of "relatively cool" gases. As a result, the initial temperature and velocity gradient in the boundary layer are altered in a beneficial manner.

Thermal degradation of the organic material may also take place with the formation of a porous carbonaceous material (char). If conditions are suitable, this char will be retained on the surface for a transitory period. Meanwhile, its refractory nature serves to protect the remaining plastic substrate from the high temperature environment.

As the thermally unstable organic components are vaporized, the surface recedes and the inorganic fibers are exposed to the hot gas stream. Melting then occurs at the surface in the form of liquid droplets, irregular globules, or a thin film. A fraction of this melt vaporizes and the remainder flows along the body under the influence of the external pressure and shear forces of the gas stream. Molten material may resolidify on the downstream portion of the body where the heating is less intense, thus introducing first-order changes in body geometry (11).

Performance criteria

The performance of an ablative material is generally measured in terms of its thermal efficiency, insulative value, and linear erosion. Various heat of ablation values are used as the criterion of material efficiency. Thermal insulation is determined by the thickness of material required to maintain a specified temperature at a given position in the substrate. Thermal-mechanical-chemical erosion of ablating plastics is measured in terms of the velocity of surface recession.

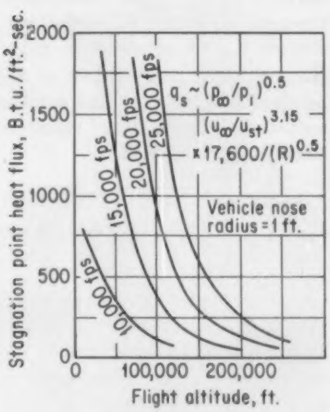

FIG. 2: Stagnation point heat flux versus flight velocity and altitude.

Heat of ablation: The first performance criterion is the heat of ablation value, which collectively expresses the ability of a material to absorb and dissipate thermal energy per unit mass expended. Effective heat of ablation is the most commonly used ablative performance value, and it is usually determined at quasi-steady state and stagnation point conditions.

The H_{eff} value expresses the relation between the incident heating rate to a non-ablating calorimeter and the rate of total mass loss. The calorimeter apparently has the same temperature, emissivity, and catalytic efficiency as the ablating material being considered. In equation:

$$H_{eff} = \frac{q_o}{m} \qquad \text{Eq. 1}$$

where

$$q_o = q_{ow}\left(\frac{H_s - H_w}{H_s}\right) \qquad \text{Eq. 2}$$

and

$$m \sim \rho_b V_w \qquad \text{Eq. 3}$$

In Equations 1, 2, and 3,

H_{eff} = effective heat of ablation

q_o = surface heating rate to non-ablating calorimeter

m = mass rate of ablation

q_{ow} = initial surface heating rate

H_s = free stream gas enthalpy

H_w = gas enthalpy at ablative surface temperature

ρ_b = density of intact material

V_w = velocity of surface recession (linear ablative rate).

The thermal efficiency of an

ablative material may also be expressed in terms of a thermochemical heat of ablation value $\overline{H_{eff}}$, which is independent of the incident heating rate and surface radiation effects. This value is closely approximated by:

$$\overline{H_{eff}} \sim \frac{q_o - q_r}{m} \sim H_{eff}\,(1 - q_r/q_o) \quad \text{Eq. 4}$$

where q_r is the radiant emission rate from the ablating surface. There is a small error due to inherent difficulty in separating all radiation effects from the heat of ablation value (12-14).

Thermochemical heat of ablation values for typical ablative materials are shown in Fig. 4, p. 137. Values are reported as a function of increasing enthalpy potential across a laminar boundary layer.

Once the material heat of ablation value has been determined as a function of appropriate environmental conditions, it may be used by designers to predict the mass loss of material from any surface position on the re-entering vehicle. This is accomplished by dividing the aerodynamic heating rate corresponding to each given altitude (pressure)-velocity (enthalpy) point on the re-entry trajectory by its corresponding heat of ablation value. Total mass ablation is then obtained by integrating the mass loss over the entire vehicle re-entry trajectory. This method of analysis is applicable to ablative materials that respond quickly to the hyperthermal environment in which transient heating effects are considered negligible.

Thermal insulation: The second ablative performance parameter concerns the ability of the surface material to insulate thermally the substrate during hyperthermal exposure. A measure of the insulation index is obtained by determining the thermal gradient in the ablating material. This is accomplished experimentally by placing thermocouples at known distances beneath the surface, and measuring the temperature-time relation at each position during exposure. Low substrate temperatures are desired so that the thickness of material required for thermal insulative purposes may be a minimum.

The rate of internal heat penetration of various ablating materials is illustrated in Fig. 5, p. 138. Several reinforced plastics and graphite models were exposed to very high temperature air from an arc heater, and temperature-time plots recorded at a fixed position in the material substrate. Graphite is shown to experience a rapid rise in substrate temperature with exposure time; while the reinforced plastics take from about two to six times as long to reach an equivalent temperature.

Thermal - mechanical - chemical erosion: Dimensional and geometric changes of a material during ablation constitute a third important criterion of performance. These changes may introduce problems in aerodynamic stability, vehicle control, performance, incident heating rate, etc. It thus becomes necessary to have a knowledge of the dimensional changes of an ablating material in advance of its use in high-temperature environments. This is accomplished by exposing a properly scaled model in the simulated service environment, and determining dimensional changes by means of internal instrumentation (ablation gages), photographic techniques, or post-exposure measurements.

Engineering materials exhibit vast differences in erosion rates upon exposure to very-high-temperature air environments. Comparative data on stagnation point linear ablative rates of representative plastic, ceramic and metallic materials are given in Fig. 6, p. 138. The desirable low linear ablative rates of certain plastics are clearly evident (15).

Table II: Ablative performance trends with variation in plastics components[a] (17)

Resin	Reinforcement material	Amount	Thermal efficiency	Weight loss
		%	B.t.u./lb.	10^{-3} lb.
Phenolic	Nylon fabric	40	7,200	5.66
		55	7,600	5.38
		70	6,400	6.37
Phenolic	Asbestos mat	40	5,600	7.27
		55	5,500	7.45
Phenolic	Glass fabric	40	6,000	6.90
		55	5,800	7.01
		70	4,900	8.37
Phenolic	Silica fabric	40	7,000	5.84
		55	7,800	5.29
		70	7,900	5.18
Melamine	Glass fabric	40	3,800	10.89
		55	3,900	10.54
		70	4,600	8.84
Melamine	Silica fabric	55	6,900	5.91
		70	7,900	5.18
Silicone	Glass fabric	70	6,000	6.79
		55	—	—
Silicone	Silica fabric	55	Delaminated	
		70	Delaminated	

[a] Test conditions: Test facility: 80 kw. arc plasma jet; Test atmosphere: Argon; Initial heat flux: 750 B.t.u./ft.^{2}-sec.; Exposure period: 10 sec. Orientation of reinforcement: Parallel to gas stream.

Behavior of ablative materials

The performance of plastics in hyperthermal environments is greatly dependent upon several mutually interdependent parameters. Both theory and experiment have shown that ablative behavior

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is a sensitive function of materials and environmental variables.

The materials parameters of importance are 1) type of resin, reinforcement, and filler, 2) ratio of individual material components, and 3) orientation of the reinforcing agent.

The principal environmental parameters are 1) gas enthalpy, 2) gas chemical composition and reactivity, and 3) mechanical forces of pressure and shear.

Each of these salient factors will be examined in the following paragraphs.

Resins: Plastics are formulated from a wide variety of thermoplastic and thermosetting resins, such as the polyamides, fluorocarbons, phenolics, silicones, epoxies, furans, and others. These resins degrade thermally by various modes and with the expenditure of different amounts of energy. Thus, they exhibit significant differences in behavior in high-temperature environments.

Organic resins such as polyethylene, polytetrafluoroethylene, and polyamides are promising for satellite re-entry applications involving a laminar boundary layer, moderately long exposure, and relatively high incident heat flux. These materials and other resinous materials such as certain epoxies, melamines, and polyesters also gasify almost completely in response to heating. Consequently, they may be used as transpirant coolants in porous refractories.

Of the common laminating resins, phenolics and modifications thereof have exhibited relatively good performance in a wide variety of very-high-temperature environments. Their desirable performance is illustrated in Fig. 7, p. 140, which gives comparative data on the ablative rates of various glass fabric laminates in supersonic rocket exhaust (16). It should be stated, however, that phenolic resins that are supplied by different manufacturers may exhibit wide variation in performance.

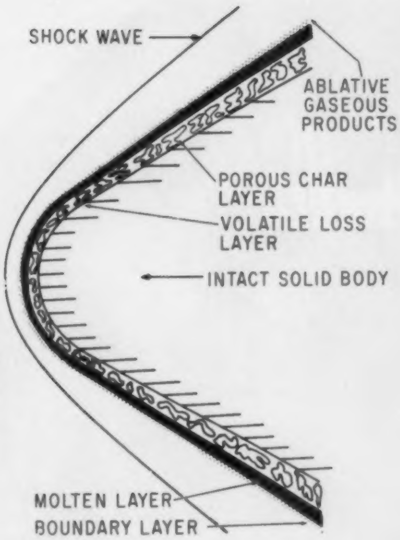


FIG. 3: Ablating plastic composite during the re-entry heating. Glass-fiber-reinforced phenolic resin served as the ablating model.

Reinforcements: Resins are often combined with various reinforcing agents to form a strong, light-weight plastic composite. A wide variety of reinforcements are available for this purpose, and they vary greatly in chemical composition and physical form. Organic fibers commonly used include nylon, cotton, polyesters, and acrylics. Inorganic fibers generally consist of glass, silica, quartz, asbestos, and various silicates. The physical form of the reinforcement also is quite variant, and includes fibers, fabrics, flakes, mats, and tapes. As a result of the significantly different properties of the reinforcements used in plastics composites, important differences may be noted in ablative performance.

Organic fiber composites have been used in missile and satellite re-entry environments where the imposing shear forces of the gas stream were relatively low. High stagnation pressures and shear forces greatly reduce the utility of organic reinforcing agents, which is due primarily to thermal degradation of the reinforcement at the substrate plastic-char interface region, and the resultant inability of the reinforcement to anchor the carbonaceous layer to the intact substrate. Under such conditions, high mechanical erosion of the residual surface char takes place, which causes an attendant decrease in thermal efficiency of the material.

Inorganic reinforcements are optimum in high mass-flow environments, such as those encountered by hypersonic flight into the denser regions of the atmosphere. Inorganic reinforcements remain essentially intact in the char substrate during exposure, and thereby serve to reinforce both the degrading surface layer and the unheated substrate plastic. Among the inorganic reinforcements, both silica and quartz fibers have exhibited outstanding performance characteristics in high enthalpy, high mass-flow environments. This is attributed to their high viscosity in the molten state, and their high enthalpy of vaporization and dissociation (about 5200 to 5500 B.t.u./lb.).

Ratio of materials components: Properties of composite plastics vary widely with the ratio of individual material components. For optimum mechanical properties, a relatively high (about 70%) reinforcement content is used. However, this high reinforcement content may adversely affect the

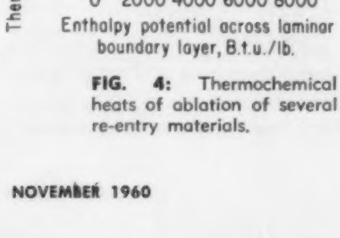


FIG. 4: Thermochemical heats of ablation of several re-entry materials.

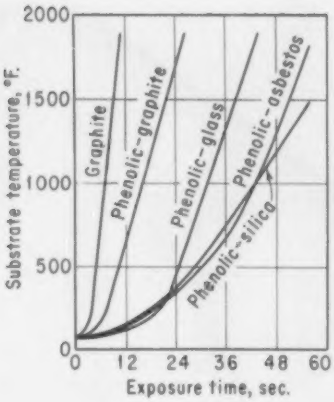


FIG. 5: Substrate temperatures in various ablating materials. Test facility: Electric air arc; Initial flux: 400 B.t.u./ft.²-sec.; Thermocouple: 0.25-in. from original stagnation point.

ablative characteristics of plastics composites. This is illustrated in Table II, p. 134, where variation in ablative performance is given for various resin to reinforcement ratios. The data were obtained in an argon plasma jet, which is an arc-gas device for heating gases to very high temperatures (17). A high reinforcement content is beneficial for the phenolic-silica, melamine-silica, and melamine-glass plastics. On the other hand, the phenolic-glass material exhibited a lower thermal efficiency with increasing reinforcement content. Unlike the other ablative plastics, phenolic-nylon had a maximum thermal efficiency at about 55% reinforcement content. Any increase or decrease from this value of reinforcement content lowered the thermal efficiency.

These experimental results indicate the variability in ablative performance of composite plastics with changes in the resin to reinforcement ratio.

Orientation of reinforcement:

Systematic orientation of the reinforcement in an ablative plastic introduces directional properties. This is especially noticeable when the properties of the component resin and reinforcement differ widely. Table II illustrates this fact, and gives certain mechanical, thermal, and ablative characteristics of a reinforced plastic made with a phenylsilane resin (phenolic-silicone reaction product) and a vitreous fiber (18).

Parallel-to-surface fibers produce high tensile and flexural strengths in the plane of reinforcement orientation, and a minimum of internal heat conduction. However, parallel-to-surface fiber orientation has two basic limitations: 1) layers of reinforcement may peel from the surface resulting in non-uniform ablation, and 2) surface spalling is most prevalent since volatiles generated in the substrate may become trapped by the closely packed fibers.

Perpendicular-to-surface fiber orientation reduces the ablative rate and maximizes the heat of ablation value. The basic defects of this type of construction are also twofold: 1) mechanical properties are relatively low in a plane perpendicular to the reinforcing fibers, and 2) a higher rate of internal heat conduction and radiation occurs along the fibers. The latter defect increases the thickness of material needed to produce a desired insulation.

In general, the most favorable plane of reinforcement orientation is a compromise between the previously described types of construction. It is known as an oriented, or shingle, layup in which the angle of fiber orientation varies up to 90° from the direction of the gas flow. Performance is optimized by the proper adjustment of the fiber angle, and by orienting the fibers downstream to the incident gas stream.

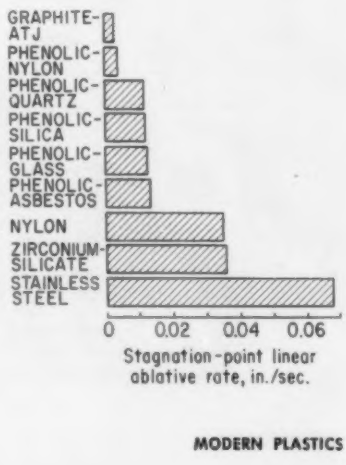
A random arrangement of the reinforcing agent in the composite produces an intermediate balance of properties. The principal advantages of random arrangements are the ease of fabricating complex shapes and a lower cost of the finished part as compared to oriented fabric layups.

Gas enthalpy: The thermal efficiency of an ablative plastic increases with the enthalpy of the environment. This relation is illustrated in Fig. 4, which shows two- and three-fold increases in the heat of ablation values over the enthalpy potential range of 1000 to 9000 B.t.u./lb. Because of this material heat of ablation-gas enthalpy relationship, there is no practical limit to the severity of the **thermal** environment in which ablative plastics may be used.

Gas chemical reactivity: The boundary layer of re-entry vehicles is highly reactive due to the presence of dissociated gaseous species and oxygen. These gaseous species may diffuse to the material's surface, exothermically recombine, and liberate a large amount of energy at the surface. Similarly, oxygen transported to the surface may initiate exothermic oxidative reactions. Hence, a highly reactive boundary layer tends to increase the rate of surface removal and lower the material's thermal efficiency.

Plastics that form a surface

FIG. 6: Linear ablation of various materials in high temperature air (15). Test facility: 1 megawatt electric arc; Gas composition: air; Gas enthalpy: ~8000 B.t.u./lb.; Gas temperature ~15,000° F.; Gas velocity: 2500 ft./sec.; Initial heat flux: 1950 B.t.u./ft.²-sec.; Exposure duration: 30 seconds.



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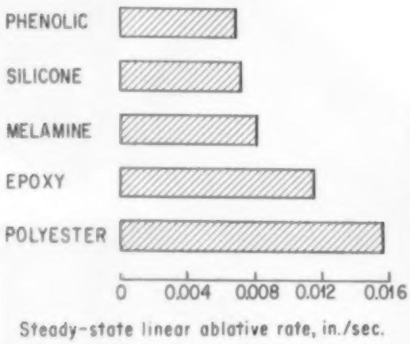

FIG. 7: Ablative rate of glass-fabric-reinforced plastics (see Reference 16). Test facility: Rocket engine; Test environment; Supersonic exhaust; Heat flux: 100 B.t.u./ft.^{2}-sec.

char during re-entry heating are generally susceptible to high temperature oxidations. For this particular case, surface removal is accomplished primarily by oxidation rather than by thermal vaporization effects.

In contrast, plastics composites that form a surface melt during ablation are usually little affected by oxygen present in the boundary layer.

Mechanical forces: Atmospheric pressure has a pronounced effect on the thermal efficiency of most plastics. As the environmental pressure decreases, a nonlinear increase in the thermal efficiency of an ablator generally occurs. This relationship is due to the effects of pressure on the surface temperature, final products of ablation, and mass transfer in the boundary layer. Consequently, ablative plastics are most efficient at high flight altitudes, which are associated with low ambient pressures.

The action of aerodynamic flow on ablating materials produces shear stresses at the solid-gas or liquid-gas interfaces. If the mechanical forces of shear are relatively high, the rate of surface removal may also be high because of particle loss (erosion) or sloughing (liquid run-off). High shear forces acting on the ablating material, then, tend to decrease the thermal efficiency by removing a fraction of the material to a position where it can no longer affect the environment of the ablating model.—**End, Part I.**

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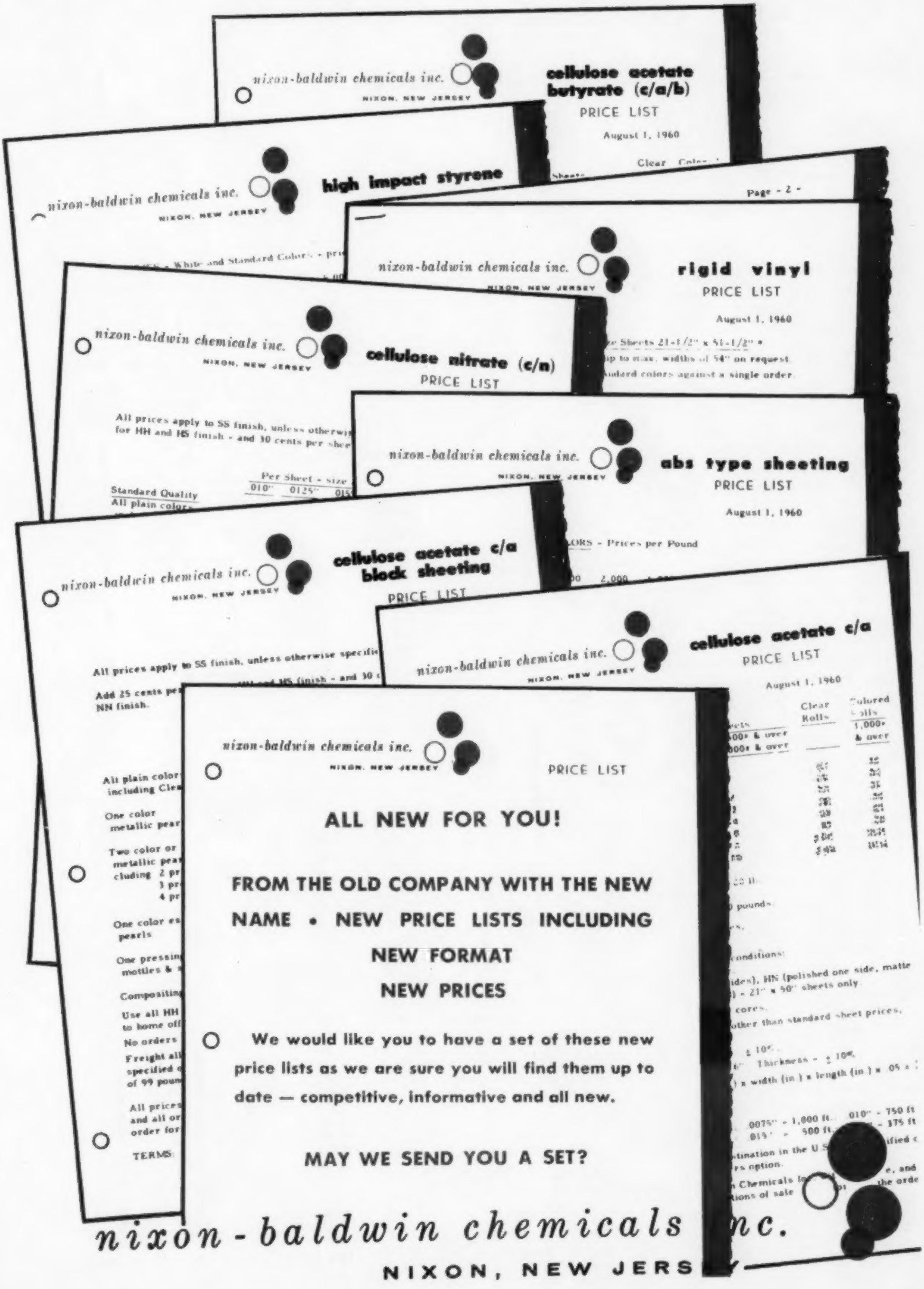
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Device for measuring stress relaxation of plastics

By R. J. Curran*, R. D. Andrews Jr.*, and F. J. McGarry*

The value of stress relaxation measurements as a means of studying the mechanical behavior of polymers is well established. The technique has been widely used for essentially static observations, when the stress decay rate under constant strain conditions is low (1).[1] Recently an extension of the method to high speed measurements to study the dynamic properties of elastomers has been reported (2).

Although normally executed as a nondestructive test, it is also possible to produce crazing or complete fracture of the relaxation specimen by initially straining it to high levels; thus, an analog to the creep-rupture or static fatigue test can be obtained. Many engineering applications of plastics involve such service (3,4). It is also felt that more fundamental information about the fracture process may possibly be so derived. With respect to crazing and fracture phenomena most plastics exhibit a marked sensitivity to environmental effects; for example, water lowers the strength of glass-fiber, reinforced laminates and common solvents, and oils are notorious attackers of many thermoplastics. For this reason fracture studies of polymers must involve positive control of the environmental surrounding the test specimens.

To permit numerous relaxation tests at a variety of stress, temperature, time, and media conditions, the apparatus shown in Fig. 1, right, has been developed. It consists of a cast aluminum frame or yoke,[2] the rigidity of which is several orders of magnitude greater than that of the typical specimen used with it. An extension is applied to the central gage length of the specimen by hand rotation of the external nut mounted on a keyed micrometer screw; the other end of the screw is connected to the upper set of specimen grips. The desired strain level can be established by a clip-type extensometer temporarily attached to the specimen for the initiation of the test or by a prior correlation between strain and rotation of the loading nut. The force in the specimen is indicated by a thin strip steel weighbar on which is mounted a four-arm bridge composed of resistance strain gages providing temperature and bending compensations. The capacity of the load cell is approximately 1300 lb. to fracture and a maximum working load of 700 lb. is permitted. With the system design as subsequently described at maximum sensitivity a force of 15 g. produces 1 in. chart deflection, which is more than adequate for most plastics materials. The load cells are sealed with wax to exclude moisture and solvent attack on the gage adhesive when such environments are used for test purposes.

Dimensions and details of the various parts are shown in Fig. 2, right, illustrating the compact simplicity and economy of construction which the unit offers. Further convenience and flexibility are provided by the individual enclosure units, Figs. 3 and 4, right, also based upon aluminum castings, which permit various local environments for each test specimen. One can envision, for example, a series of elevated temperature tests with various concentrations of solvent vapor when all the units are located in a common temperature chamber but with each unit undergoing different vapor concentrations; the experimental convenience so obtained is attractive.

In the instrumentation and recording phases of the system convenience is again the keynote. Fig. 5, p. 146, shows these arrangements schematically and indicates the full circuit details for a single channel. At suitable intervals, the Leeds and Northrup Speedomax Recorder is turned on by a timer switch for a preset period. During this period a gear-driven gang switch connected to the recorder-chart drive mechanism sequentially leads the outputs of the test units to the strain gage amplifier, and the force reading from each load cell activates the recorder. The (To page 146)

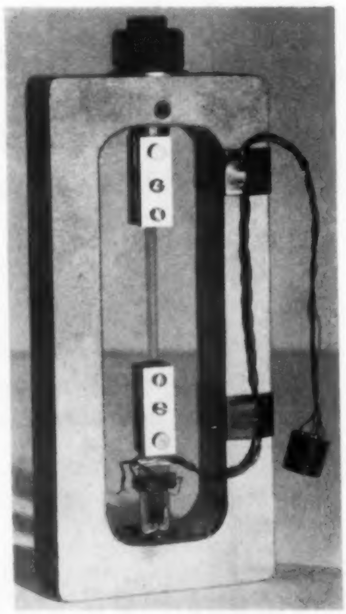


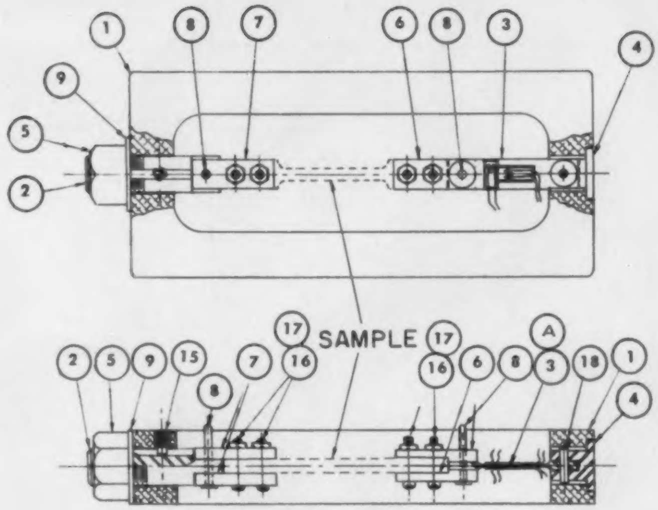
FIG. 1: Relaxation device with plastic specimen placed in grips.

*Respectively, Research Assistant, Research Associate, and Associate Professor of Materials, Massachusetts Institute of Technology, Cambridge, Mass.

[1]Numbers in parentheses denote references at end of article, p. 146.

[2]The castings used in this device are available from the Dorchester Brass & Aluminum Foundry Inc., 1550 River St., Hyde Park 36, Mass.

FIG. 2: Schematic drawing of device is numbered for parts listed below. In assembly, strain gages (Item A) are attached to mount (Item 3) with phenolic Bakelite cement (Code #33031); Items A are waterproofed with beeswax and attached to Item 3 in full bridge.



Parts List

ITEM	AMT	STOCK SIZE	MATL
18	1	⅛" dowel pin, 9/16 L. #303	st.st.
17	4	Hex. nut #6-32NC #303	st.st.
16	4	Fil. hd. m.s. #6-32NC, 3/4L. #303	st.st.
15	1	Allen full dog s.s. ¼-20-⅜ L	st.st.
A	4	Strain gage fab-25-12	BLH
9	1	Spec. washer #303	st.st.
8	2	Pin #303	st.st.
7	2	Sample Clamp #2 #24S	al.
6	2	Sample clamp #1 #24S	al.
5	1	Locknut	brz.
4	1	Gx Gage stud #303	st.st.
3	1	Str. gage mount ass'y	sp.st.
2	1	Adjust. stud #303	st.st.
1	1	Frame cast	al.

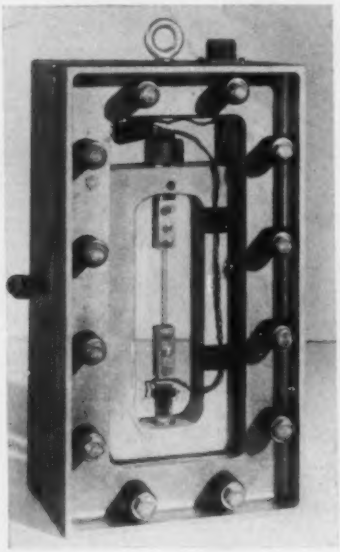


FIG. 3: Device in environmental cell.

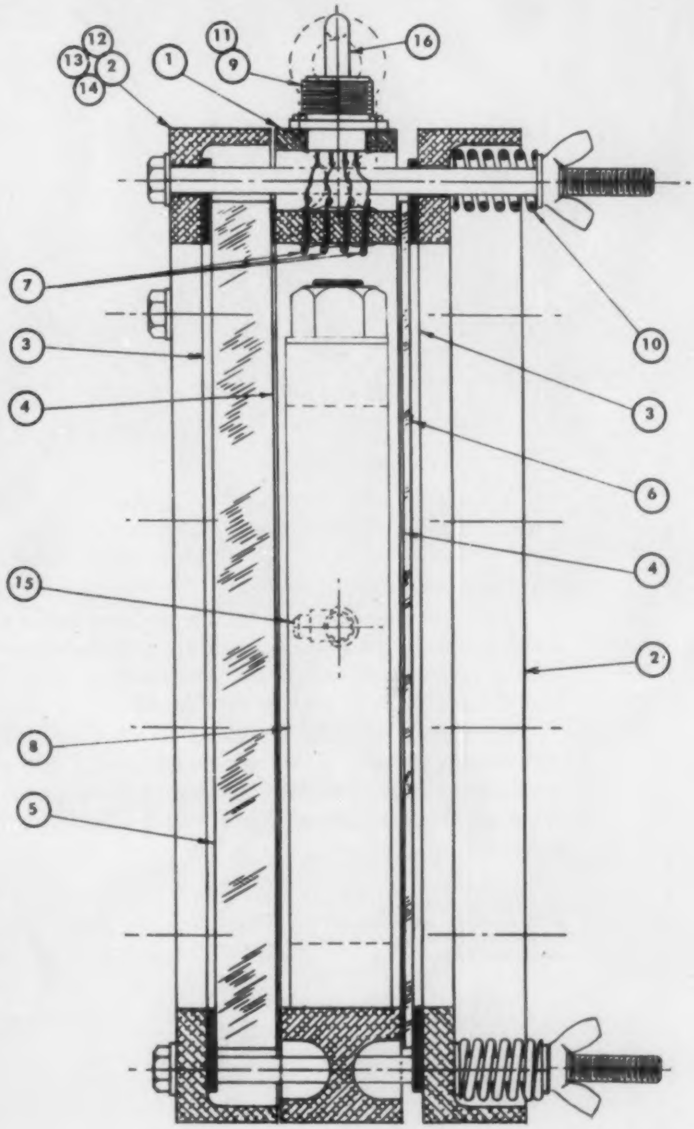
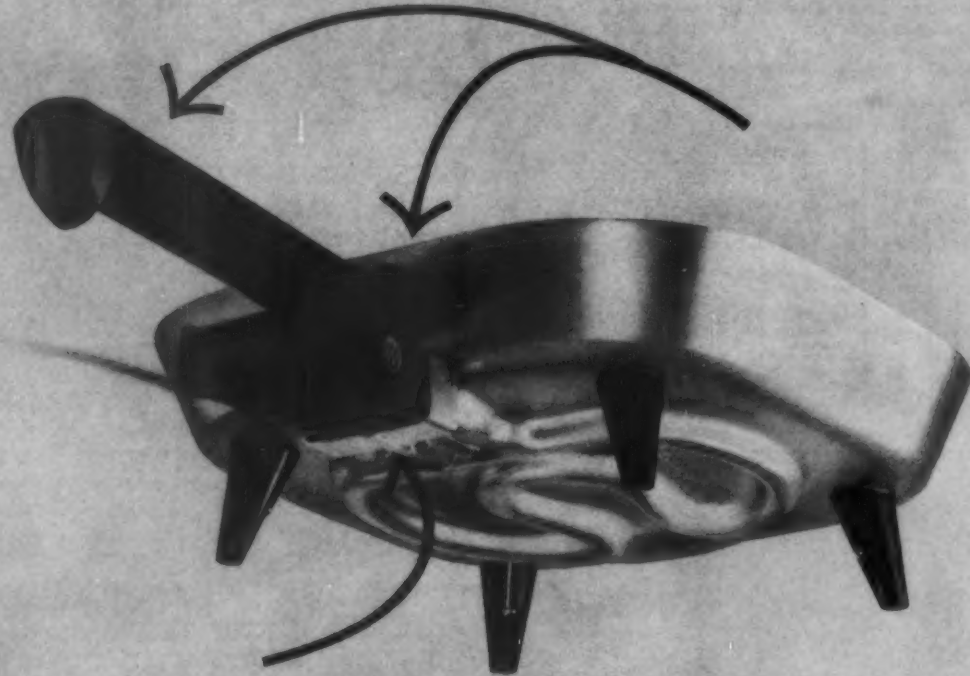


FIG. 4: Assembly drawing of environmental cell, right, is numbered for parts listed below. In drawing, Item 2 is assembled both ways to show fits with Items 5 and 6. Item 6 is used only in absence of pressure differential; Item 5 at all other times. When Item 6 is used, length of bolts (Item 12) is 4 inches.

Parts List

ITEM	AMT	STOCK SIZE	MATL
1	1	Cell	al. cast
2	2	Cover	al. cast
3	2	Load distrb. gasket	R'br. cork
4	2	Seal gasket	Sil. r'br.
5	2	Glass, thick	Plate gl.
6	2	Glass, thin	Plate gl.
7	4	Terminals	cu. wire
8	1	Stress fall fr. assy.	
9	1	Connector amphen.	14S-2S
10	12	Spring	No. note #3
11	4	Fil hd. m.s. #4—40NC, ¼ L.	
12	12	Hex. hd. car. B. #5/16—18NC, 6" L.	
13	12	Wing nuts #5/16—18NC	
14	36	Fl. washers #5/16	
15	2	⅛—27NPT to ¼ flare fit'g.	
16	1	Eye-bolt #5/16—18NC, ⅝" (⅝ i.d., 1¾ o.d.)	



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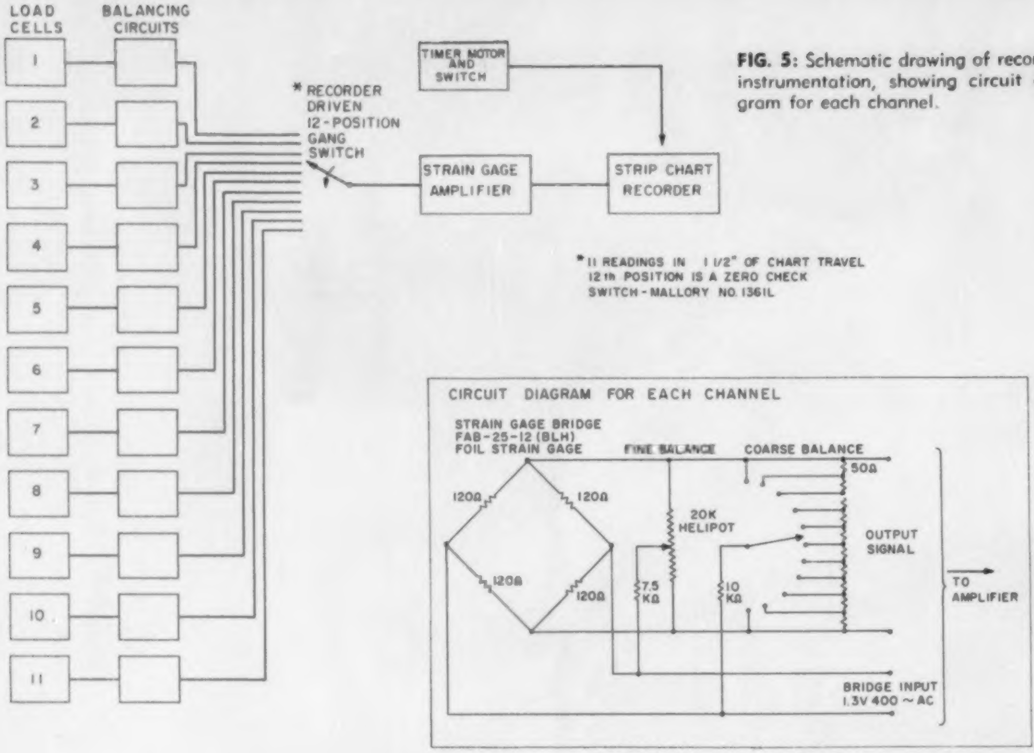

FIG. 5: Schematic drawing of recorder instrumentation, showing circuit diagram for each channel.

gear ratio is such that the 11 force readings are completed in about 1.5 in. of expended chart; the twelfth switch position checks the zero point of the recorder. With such an arrangement, multiple relaxation tests of durations ranging from a few to several thousand hours can be performed very economically, in terms of manpower and capital equipment requirements, because once the test has been started no further attention is required until the end point is reached.

An interesting example of data that can be obtained with the apparatus is shown in Fig. 6, below; the material used in these tests is a composite one, with brittle and rubbery components. As the brittle phase experiences local, fine-scale cracking, a greater proportion of the force resisting the imposed deformation derives from the rubbery inclusions which more readily undergo stress relaxation. The resultant behavior is one of an increasing stress decay rate, in contrast to the action of homogeneous materials for which the decay rate decreases with time.

Careful analysis of such data also permits the determination of limit conditions under which the cracking does not take place, indicating service for which the composite material performs satisfactorily and, at the same time, retains its continuity.

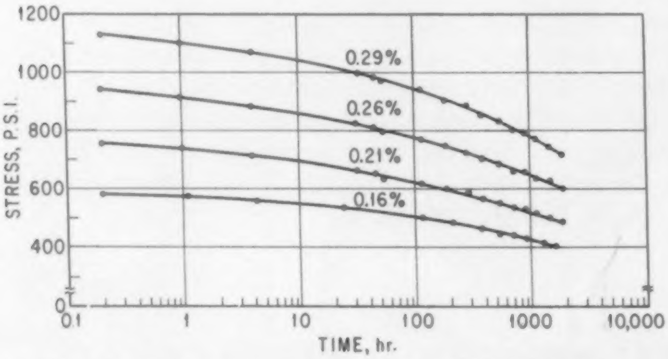

FIG. 6: Typical data on stress relaxation for multiphase thermoplastics.

Acknowledgment

This apparatus was developed in the M.I.T. Plastics Research Laboratory, Prof. A. G. H. Dietz, Director, which is supported by a Grant-in-Aid from the Manufacturing Chemists' Association Inc. Valuable suggestions to simplify the design of the load cell to its present form were made by W. D. Harris, Plastics Technical Service, The Dow Chemical Co.

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Resistance of plastics to ethylene oxide

By Marshall Dick[*] and Charles E. Feazel[†]

Commercially available plastics films were screened in the laboratory for permeability to ethylene oxide. On the basis of its relatively low permeability and its conformity to other requirements (strength, low cost, transparency, flexibility, storage), polyethylene was chosen as the preferred film for fabrication of the item: bags for bacterial decontamination. Full-sized bags of 6-mil polyethylene were used in tests to determine overall leakage rates of ethylene oxide through the film seams and bag closure. Tests with contaminated clothing showed that sufficient ethylene oxide for decontamination would be retained for the necessary length of time. Rough-handling tests of the bags in service indicated that the bags would withstand normal usage.

Ethylene oxide is well established as a bactericidal (1)[1] and insecticidal (2) agent. The work described in this article was undertaken to develop a disposable plastic bag, about the size of a duffle bag, 2 by 6 ft., for use as an ethylene oxide decontamination chamber. The decontamination would be carried out by placing clothing or other articles to be sterilized in the bag with an ampoule containing ethylene oxide, closing the bag, and allowing the closed bag to stand for the time necessary for decontamination (3). To reduce the flammability hazard associated with ethylene oxide, a mixture of ethylene oxide and chlorofluorohydrocarbons was used in the ampoule (4).

Although the decontamination bag was developed as an item for military use, it should have application in the public health and fumigating fields.

This investigation encompassed two permeability studies: first, a determination of the permeability to ethylene oxide of small samples of numerous plastics films, and in the second place, a determination of the permeability of entire plastics bags.

These studies were followed by rough-handling tests of commercially fabricated bags as well as decontamination experiments in these bags.

Permeability of films

Commercially available plastics films were evaluated for permeability to ethylene oxide in a laboratory apparatus in which one side of the film was exposed to one atmosphere of ethylene oxide while the other side was swept by a current of nitrogen. A diagram of the apparatus is shown in Fig. 1, p. 150.

The film was clamped between the two halves of the test apparatus, exposing a circular area of 6.0 sq. inches. Gaskets of rubber dental dam were used on the clamping edges. Since no appreciable pressure differential existed across the film, it was not necessary to support the exposed film. Pure ethylene oxide gas, from a cylinder, was passed through one half of the chamber at a rate of 500 cc./min. Nitrogen was passed through the other half at the same rate and thence into an absorption trap which collected

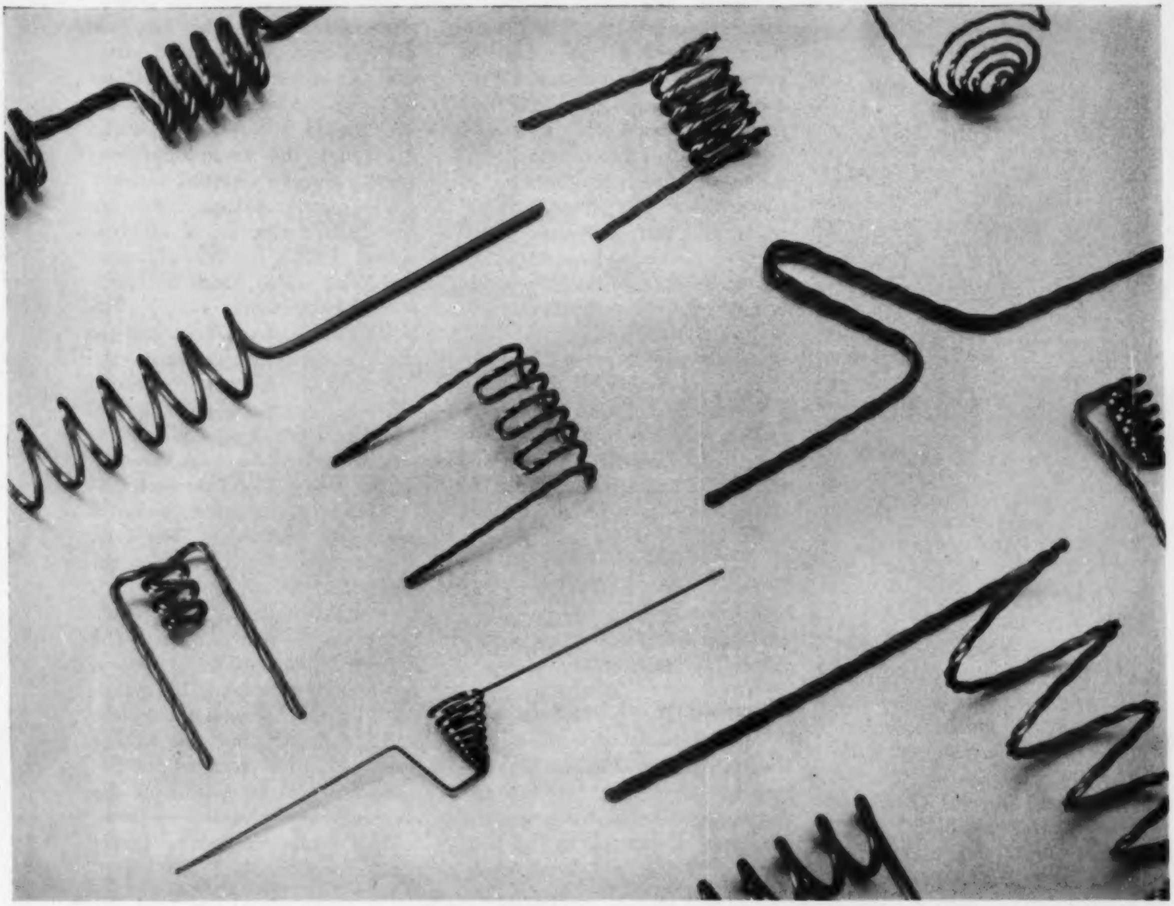
Table I: Permeability of plastics films to ethylene oxide

Film	*Thickness* mils	*Permeability*[a]
Cellophane 300 PT62	0.9	0.00[d]
Polyvinyl alcohol	3.7	0.00[d]
Polyester polyethylene terephthalate	1.0	0.00[d]
Vinyl and vinylidene plastics		
Polyvinyl chloride-nitrile rubber blend	2.2	1.0
Polyvinylidene chloride	1.0	0.1
Polyvinylidene chloride blend	1.1	0.6
Polyvinyl chloride	1.1	2.0
Polyethylene	1.4	0.35
	1.9	0.35
	2.4	0.33
Ethylcellulose[b]	3.0	3.9
Ethylhydroxyethylcellulose[b,c]	3.2	3.4
Cellulose acetate		
Rigid	0.9	1.0
Plasticized	0.8	2.4
Rubber hydrochloride		
Type A	1.0	0.1
Type B	1.0	0.2
Type C	1.0	1.3

[a]Permeability = $\frac{\text{amount of ethylene oxide (mg.)} \times \text{film thickness (mils)}}{\text{film area (sq. in.)} \times \text{time (min.)}}$. [b]Cast from solution. [c]Plasticized with 10 parts of di(2-ethylhexyl) phthalate per 100 parts of resin. [d]Indicates that permeability, if any, was below the limits of this method.

[*]United States Army Chemical Corps Engineering Command, Fort Detrick, Frederick, Md.
[†]Southern Research Institute, Birmingham, Ala.

[1] Numbers in parentheses denote references which appear at the end of this article, p. 233.



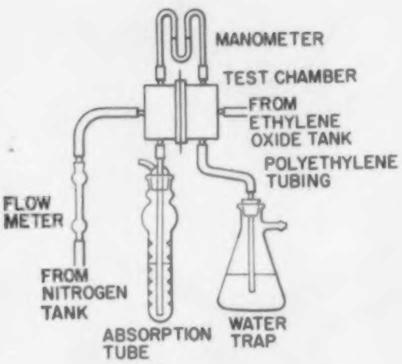


FIG. 1: Permeability apparatus used in testing plastics. Nitrogen and ethylene oxide were passed on opposite sides of plastics films in test chamber at same rate, with nitrogen flowing into absorption tube to test for pick-up of other gas.

any ethylene oxide permeating the film.

The trap contained 25.0 ml. of an absorbing liquid composed of a saturated magnesium bromide solution in acid, plus a few drops of bromcresol purple. The solution was made by adding 100 ml. of 0.05 *N* sulfuric acid to 500 g. of magnesium bromide hexahydrate. This type of solution has been used for the quantitative determination of ethylene oxide (5) according to the reactions:

$$2\,\underset{\diagdown O \diagup}{CH_2CH_2} + MgBr_2 + 2\,H_2O \rightarrow$$

$$2\,\underset{OH\quad Br}{CH_2CH_2} + Mg(OH)_2$$

$$Mg(OH)_2 + H_2SO_4 \rightarrow$$

$$MgSO_4 + 2\,H_2O$$

The permeability of a film was estimated by measuring the time required for approximately 15 mg. of ethylene oxide to penetrate the film and to neutralize 25.0 ml. of the standardized reagent. The test was carried out for a maximum exposure of 30 min.: if sufficient ethylene oxide had not been absorbed by that time to neutralize the reagent, the reagent was back-titrated with standardized sodium hydroxide to determine the amount of ethylene oxide that had been absorbed.

This method did not measure a true or equilibrium permeability, but it was useful as a rapid screening test to establish the relative permeabilities of plastics films. Table I, p. 148, gives the results that were obtained. Ethylene oxide permeability measurements have been made by Waack (6) using a high-vacuum technique. A direct comparison between the results obtained in this study and that of Waack cannot be made, because the permeability coefficients were defined and calculated differently in the two investigations. However, the relative values and order of results compare favorably.

Cellophane, polyvinyl alcohol, and polyethylene terephthalate were impermeable to ethylene oxide under the test conditions. Also, cellophane showed no measurable permeability after exposure to ethylene oxide for 18 hours. A sample of polyethylene terephthalate exposed to ethylene oxide for 2 hr. did not show any detectable permeability.

Permeability of bags

The following procedure was used to measure the total leakage rate of ethylene oxide through the walls, seams, and closure of a full-scale decontamination bag. Bags, 2 by 6 ft. flat, were fabricated from polyester, polyvinylidene chloride, and polyethylene films. The bags were filled with clothing, and in each bag was placed a metal container of ethylene oxide. The mouth of the bag was tied with an overhand knot or with string, and the ethylene oxide released inside the bag from a small metal container, as described below. The bag was then placed in a sealed drum through which air was circulated to sweep the leaking ethylene oxide into an absorption apparatus containing the magnesium bromide reagent described above.

The metal container inside the bag held a mixture of ethylene oxide (12%), dichlorodifluoromethane (44%), and trichloromonofluoromethane (44%). The chlorofluorohydrocarbons act as inert diluents to eliminate the flammability hazard associated with ethylene oxide gas. The total amount of ethylene oxide in the container was 44 grams. The container was a 12-oz. aerosol dispenser, similar to those used for packaging insecticides. The 1-in. opening in the top of the container was sealed with a flat cap with a very small opening, over which was fitted a steel or brass rod. The rod was snapped off the container, releasing the contents, by grasping it through the wall of the plastic bag. The container was held or propped up in an inverted position to insure a rapid release of the ethylene oxide mixture.

The results of these experiments are shown in Fig. 2, below. It is evident that a large amount of the gas leakage occurred through the knotted mouth of the bag. This is shown by the greater overall leakage through the polyester and polyvinylidene chloride bags than through the polyethylene bags, even though the film permeabilities are in the reverse order since the **(To page 226)**

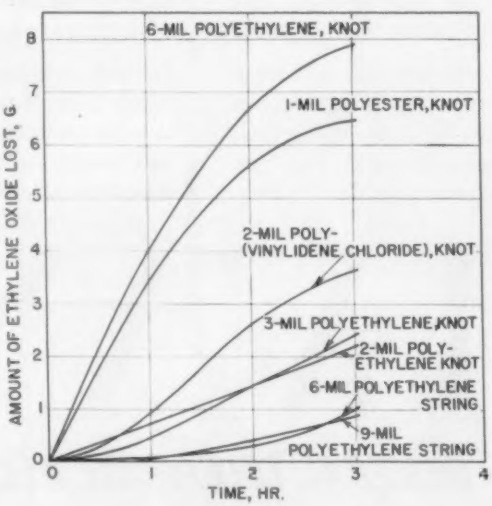


FIG. 2: Test of plastic bags for permeability to ethylene oxide showed that the type of knot or closure used would affect the efficiency of the decontamination system.

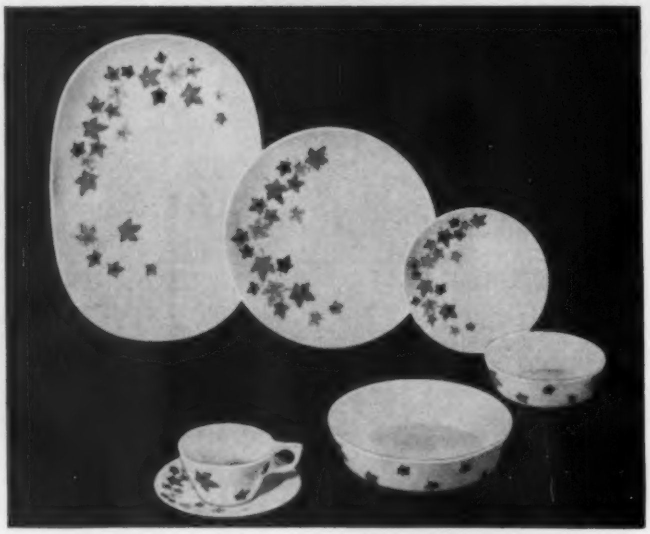
NEW DEVELOPMENTS

Many minds at work on new ways to use plastics, new designs, and new product concepts offer ideas you can use.

Polyethylene coal chutes

Formed high-density polyethylene (PE) has invaded the coal industry in the form of chutes, storage bin liners, buckets, and other equipment, replacing traditionally used steel. The items are produced by Abutco Plastics Industries Inc., Hazleton, Pa., of sheet extruded by the firm from Fortiflex resins supplied by Celanese Polymer Co. All items are produced in natural colors. (For work done by Abutco in formed PE equipment for the construction field, see "Giant thermoformed parts," MPl, Sept. 1960, p. 96). The principal advantage of high-density PE over conventional steel in these applications is the superior resistance of the plastic to corrosion by acids that are present when coal is conveyed in mixture with water. This advantage expresses itself in reduced maintenance and replacement costs. High-density PE also costs less than stainless steel now used for coal chutes and is in the same price range as high-carbon steel used in these applications. Being only one-eighth as heavy as steel, the new chutes save on installation time and costs.

According to the company, polyethylene chutes have shown that they are as tough as their steel counterparts in resisting abrasion by the finer grades of anthracite, and that they perform well in handling all grades of bituminous.



Now—U. S.-deep-draw decorated melamine

Fully decorated melamine dinnerware, including cups and bowls, is now produced commercially in the United States. While flat or shallow-draw plates have been produced with molded-in foil decorations in this country for some time, only in Europe were bowls, cups, and other deep-draw items produced with molded-in foils. In the United States, cups and bowls, if side-decorated at all, were ornamented by decalcomania spot, not molded-in resin-impregnated foils. (The new decorating techniques were fully described in "Plastics in the product revolution: Decorated thermosets," MPl, June 1960, p. 96).

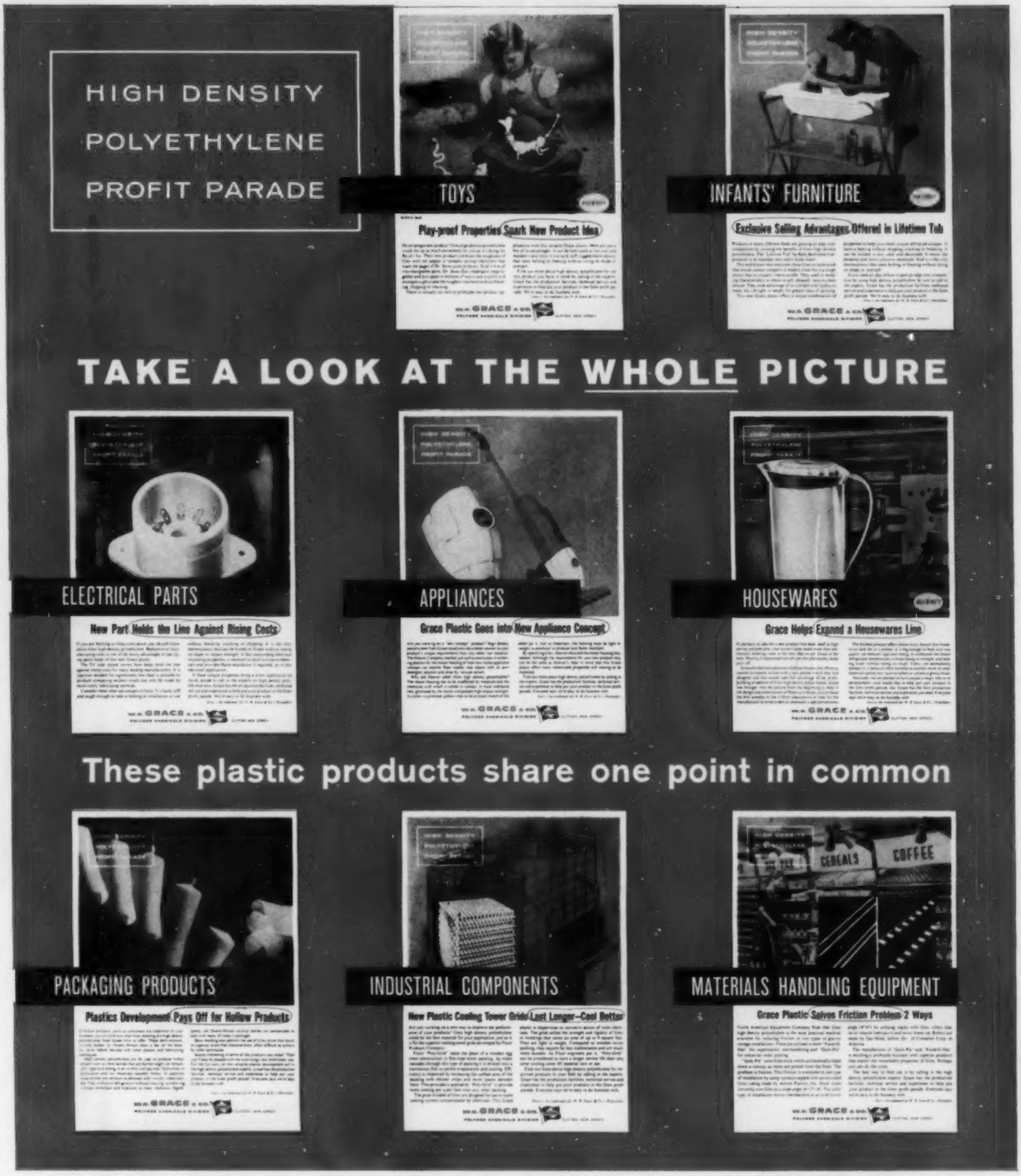
The setting shown in the illustration was produced by Plastics Mfg. Co., Dallas, Texas, and is thought to be the first time that such fully decorated dinnerware has been produced in the United States.

Acid-proof PVC conveyor system

Said to be the first of its type in the world, a vast PVC roller conveyor network has eliminated losses from sulfuric acid corrosion and done away with awkward push-tables along the storage battery production line at Scranton Battery Co., Scranton, Pa. The 2650-linear ft. roller conveyor system has also streamlined the entire operation, from assembly through to charging, refilling of batteries with high acid, and finishing. The roller conveyor system is subject to a punishing combination of abrasion and sulfuric acid corrosion.

The company had been using—and replacing—metal push-tables and metal rollers for years. Handling was slow, and equipment losses from severe corrosion a certainty. A brand new concrete floor, over which the push-tables used to roll, was completely shot in eight years, according to the company.

The conveyor network, designed by the battery company in cooperation with engineers of A. M. Byers Co., uses more than 18,600 ft. of Byers Type I PVC pipe for rollers and shafting. Rollers are Schedule 40, 1½-in. pipe and vary in length from 8 to 16 inches. PVC bushings cemented inside the roller ends accommodate the roller axles, which are fabricated from Schedule 80, ¼-in. PVC pipe. The length of the roller axles ranges from 10 to 18 inches. Before installation, a single Byers PVC roller (To page 156)



These products offer concrete evidence of manufacturers who have realized the profit-making opportunities to be found in high density polyethylene from W. R. Grace & Co. New products . . . better products . . . products that last longer . . . cost less to make . . . products with greater sales appeal . . . products that complete a product line—all can start with Grex High Density Polyethylene. If you have an application for high density polyethylene—or think you have—it will pay you to call Grace.

Grex is the trademark for W. R. Grace & Co.'s Polyolefins.

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POLYMER CHEMICALS DIVISION CLIFTON, NEW JERSEY

EGAN PRESENTS A COMPLETELY NEW LINE OF EXTRUDERS *with the improved Willert temperature control system!*

Now better than ever . . . Egan's famous "Willert Temperature Control System," which gained world-wide acceptance in the thermoplastics extrusion field for its uniform thermal regulation, regardless of viscosities or melt temperatures!

The heart of the new Willert System is its AIR COOLED CONDENSERS, which are constructed of high pressure finned tubing and are mounted within the cylinder covers of the extruder. Automatically controlled blowers are mounted in the base (see photo at lower right).

Egan Extruders equipped with the improved patented Willert Temperature Control System automatically dissipate excessive frictional heat. The result is closer tolerance extrusions at greatly increased outputs.

Egan Extruders with the new Air Cooled Willert System are available in sizes from 2" through 12", with L/D ratios of 20:1, 24:1, 32:1.

DESIGN AND GENERAL CONSTRUCTION

With this system, each individual zone along the cylinder is jacketed. The jacket is formed by a series of circumferential grooves, connected by channels on the top and bottom, with steel sleeves welded on the outside. An air cooled reflux condenser assembly is connected to the top of each jacket and a condensate return line connects the vapor pressure chamber and the bottom of cylinder. All joints, with the exception of the vent valve and filler plug, are welded to eliminate the possibility of leaks. Each zone is a completely closed system.

Heater bands are mounted around the steel jackets.

Each cylinder section is filled with a liquid heat transfer medium, which has a relatively flat vapor pressure vs. temperature range curve (water for temperatures up to 465° F and Dowtherm A for temperatures from 350° to 700° F are used), and, upon initial heat-up, the system is vented to remove air and noncondensable gases.

OPERATION AND COMPARISON

As the cylinder is heated, a vapor pressure, corresponding to the temperature of the cylinder or the heat transfer medium is maintained within the pressure chamber. The liquid will not boil as long as this pressure is maintained.

If cooling is required, due to a build-up of frictional heat or possibly due to a desire to lower the temperature in the zone, the thermocouple, which is located in the cylinder close to the liner, senses the excessive heat, and activates the blower. This, in turn, condenses some of the vapor, reduces the pressure and thus the liquid in the jacket begins to boil. The condensate returns to the bottom of the cylinder, setting up a circulating system.

Since only the latent heat of vaporization is removed, the vapor and the condensate are of essentially the same temperature; consequently, the control is gradual, producing no shock cooling to the cylinder, but removing the excessive heat most efficiently. The design of the jacket is such that the cooling takes place over the full length and full circumference of each zone, thereby eliminating any possibility of thermal distortion. There are no hot or cold spots.

SUMMARY OF ADVANTAGES

1. Completely automatic.
2. Completely self-contained.
3. No manually operated valves or switches.
4. Heating or cooling is uniform over full length and circumference of each zone.

The Egan Extruder illustrated below is a 4½" model with 24:1 L/D ratio.
Patented
Egan
CABLE ADDRESS: EGANCO—SOMERVILLE, NJER
FRANK W. EGAN & COMPANY
SOMERVILLE, NEW JERSEY
MANUFACTURERS OF PROCESSING MACHINERY FOR PAPER, FILM & FOIL, AIR DRYING SYSTEMS; ROTOGRAVURE PRINTING PRESSES; PLASTICS EXTRUDERS & ACCESSORIES; TEXTILE FINISHING MACHINERY
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FRANCE—ACHARD-PICARD, REMY & CIE., Paris
GERMANY—ER-WE-PA GmbH, Duesseldorf
JAPAN—MINAMI SENJU MFG. CO., LTD.
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REPRESENTATIVES
ITALY—ING. LEO CAMPAGNANO, Milano
MEXICO—M. H. GOTTFRIED, Mexico, D. F.

NEW DEVELOPMENTS

(From page 152)

assembly was subjected to a series of tests. Operational loads of 80 and 120 lb. were applied at temperatures of 72, 120, and 140° F. The PVC roller deflection was so slight as to be immeasurable. At center point loads of 380 to 400 lb., roller deflection was approximately 1.5 in. with immediate springback to original form after the load was removed. Spread over a series of rollers, of course, deflection even at this load was slight. There was no question as to the material's resistance to abrasion or sulfuric acid corrosion.

The PVC roller conveyor system is in excellent condition after more than a year of service, while a 50-ft. test section of metal rollers was badly deteriorated after only six months' use.

Acrylic enclosed relay

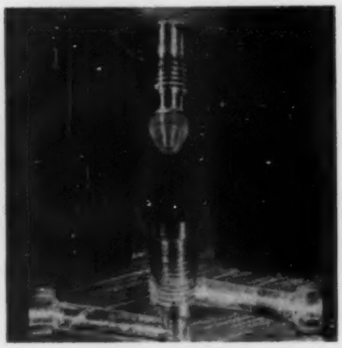
Sheets of corrugated Plexiglas acrylic, used to enclose the microwave relay station of the New York Telephone Co. on the 87th floor of the Empire State Building in New York, N. Y., have enabled the station to increase the number of its transmission antenna disks from 4 to 12. Purpose of the station is to relay television pictures from TV cameras on location to broadcasting points.

Because the antennas must be installed on the periphery of the building, it is necessary to protect them against the elements. Prior to this installation, the antennas were located on an open platform, each disk protected by an acrylic igloo (see photo). These domes, 7 ft. in diameter and 9 ft. high, occupied so much of the available platform space that there was room for only four.

The Plexiglas sheet used in the enclosure is formed in a special "flatbottom Vee" corrugation pattern, which serves a dual function. It stiffens the panels and eliminates objectionable microwave reflections. At the same time, the flat sections of the Vee provide a distortion-free area through which visual sighting is an aid in positioning the antennna.

The sheets were formed and installed by Universal Unlimited Inc., Glen Cove, N. Y. Sheet thickness is ¼ in.; total area enclosed is 560 sq. feet. Sheets are about 6 ft. high and vary in width from 24 to 40 in. to meet installation needs. Reinforced acrylic strips, attached with nylon belts, provide weather-tight joints between adjacent panels.

ANTENNA DISKS are now housed in trouble-free enclosure of corrugated Plexiglas acrylic panels (above). Disks were formerly housed (left) in individual acrylic domes which, in turn, were covered by rope netting to prevent them, or pieces of them, from blowing off the building. New housing encloses 560 sq. ft., houses 8 additional disks.



Kel-F valve part

A change from stainless steel to halofluorocarbon (Kel-F) stem tips in small-diameter needle valves (above) made by Hoke Inc., Cresskill, N. J., has virtually eliminated the problem of valve seat scoring.

Excessive tightening of the previously-used steel tips often caused scoring and galling of the metal valve seat, eventually leading to leakage. But valves featuring the halofluorocarbon tips have been tested with no adverse effects through 5000 opening and closing cycles at 3500 p.s.i., even at twice the normal closing force.

In addition, control of highly-corrosive industrial acids and gases has been improved by the Kel-F tips because of the material's chemical inertness. The wide operational temperature range (up to 450° F.), low cold flow characteristics, and minimal swelling of the material were other reasons for its selection.

Kel-F rod is supplied by Minnesota Mining & Mfg. Co., St. Paul, Minn. The tips are machined from the rod by Hoke, which uses automatic screwing machines. The tips, designed for use with ⅛- and ¼-in. O.D. stainless steel valves, are held in place by a crimped metal shell around the base of the tip.

Safety for drinkers

Shards of broken glass will no longer present hazards at pool and patio parties if the cocktail glasses used are those recently introduced by Rainbow Plastic Products Inc., Minneapolis, Minn. These new glasses are molded in a pleasing design of Dow's Zerlon, a methyl methacrylate-styrene copolymer material characterized by chemical resistance and impact strength.

According to Dow, the molded Zerlon glasses are crystal clear, resist discoloration and stress cracking when in contact with alcoholic beverages, and will not break. As produced by Rainbow, **(To page 158)**

Big in BOTTLES!

More Hartig Extruders are used in blow molding bottles than any other make.

There are good reasons for **Hartig's** popularity—dependable performance—prompt service. Inherent in all **Hartig** machines is a technical competence in design and manufacture that pays off in performance.

Typical of the **Hartig** Extruders for blow molding installations is the 2½"–20:1 L/D ratio extruder shown. With flamehardened SAE 4140 steel feed screw in a centrifugally cast Xaloy lined barrel, this machine features a four zone heating system utilizing cast-in-aluminum heaters—3 on the barrel, 1 on the die.

You'll be interested in the new Waldron-Hartig Bulletin LF-1 which gives the story on our laboratory facilities available for experimental and pilot plant studies. Write for your copy.

HARTIG EXTRUDERS

WALDRON-HARTIG DIVISION
Midland-Ross Corporation
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HE-960

EXTRUDERS • SPECIAL FEED SCREWS • MASTICATING HEADS • MANIFOLDS • DIES (ALL TYPES) • CONTROL PANELS • ACCESSORY EQUIPMENT

(From page 156)

CLARITY as well as high gloss of methyl methacrylate-styrene copolymer makes material suitable for injection molding well-designed cocktail glasses.

the cocktail glasses are 4½ in. high, weigh 2½ oz., and hold 4½ oz. of liquid. They are priced at $6.95 per dozen. Other Zerlon bar glasses are in the planning stage; Old Fashioned glasses will probably be the next.

Fire-resistant pipe

Originally developed as paint carrying drop lines for car manufacturers to reduce fire hazard in spray painting, the Synflex Hi-Temp hose is also suited for chemical lines and the handling of flammable fluids.

The central core is a specially formulated nylon tube, covered with black vinyl, and wrapped with Mylar-backed asbestos tape. The outer covering is 0.012-in. galvanized steel armor.

According to Synflex Products Div., Samuel Moore & Co., Mantua, Ohio, manufacturer of the hose, installation costs are substantially less than with conventional black iron pipe. This is because the new pipe is flexible and contours readily to existing equipment, eliminating the need for many fittings, elbows, nipples, etc. The hose is available with an inner diameter of ⅜ in. and outside diameter of 0.718 inch. Tested in a 2000° F. flame, the pipe still has good paint flow, and showed no indication of flaming after 15 min. in the flame, the manufacturer states.

ABS capped fastener

Bolts, work horses of the metal fabricating industry, are being capped with Kralastic MM acrylonitrile-butadiene-styrene copolymer produced by U. S. Rubber Co., Naugatuck Chemical Div., to extend their usable life under high-rust or chemically-corrosive conditions. The capping method was developed by Clear-Cite Products, Chicago, Ill. The new bolts are used to cut basic costs of huge glass-lined steel silos made by A. O. Smith Co., Cleveland, Ohio. Each silo was formerly held together by 5000 stainless steel-topped bolts. Expensive stainless steel was necessary because the juices formed by silage are highly corrosive. The stainless steel-topped bolts also required use of asbestos gaskets to make a tight seal.

When an attempt was made to use plastic in place of stainless steel, the first plastics failed because the thin plastic layer molded over the bolt head was squeezed off the underside of the head when it was tightened with the 30 lb. of torque required in silo building. ABS solved this "squeezing" problem, although just a fraction of an inch is molded in a layer over the bolt head.

Millions of the plastic-capped bolts are now in production for Smith silos. Their cost is about half that of the bolts capped with stainless steel.

Other applications under study include bolts in wiring devices and large steel components; galvanized farm buildings; metal-plating tanks; outdoor signs; and many other special metal fabricating uses where rust or corrosion is a problem.

Rustproof delivery tube

Many suburban and rural newspaper readers now take their papers out of a colorful new delivery tube which is rustproof, corrosionproof, weather and abuse resistant. It is the PermaTube, molded for the Newspaper Enterprise Assn. Service Inc., Cleveland, Ohio, by the General Industries Co., Elyria, Ohio, out of Marlex high-density PE material.

NEA's reason for switching to plastic? The polyethylene tubes, unlike their metal counterparts, are impervious to water, snow, and ice or the chemicals used to melt the latter. In some areas along the southern seacoast, metallic tubes last only six months in the salt air and humidity. While no one is certain yet as to the life of PermaTubes, laboratory tests indicate a minimum life of six years, and in some areas they will last practically forever.

Distribution of PermaTubes is a distinct departure from NEA's normal operations since NEA is primarily a newspaper feature syndicate producing editorial and pictorial material. But NEA officials went into production and distribution of a "hardware" item because PermaTubes are a product that the newspaper industry has sorely needed for years. Meade Monroe, NEA vice president, reports that 60 newspapers have adopted PermaTubes for rural route delivery since they were introduced a relatively short time ago.

In design the PermaTube had to be highly impact resistant, resilient enough to stand up to attack by small boys with stones and sticks. Assuming that tubes might be placed in areas where industrial fumes might be a problem, corrosion resistance was a must. Finally, it had to have adequate drainage and a smooth beaded edge that would not cut or tear the newspapers.

Final design is a rounded-square tapered tube 18 in. long with a front

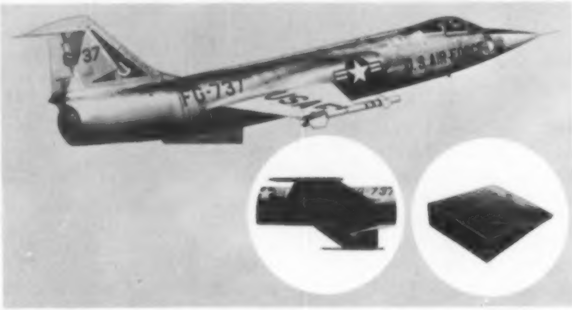
HIGH-DENSITY POLYETHYLENE newspaper delivery tubes are rustproof, corrosionproof, and weather and abuse resistant. Unlike their metal counterparts, these PermaTubes are impervious to water, snow, and ice or the chemicals that are used for melting ice. The tubes are 18 in. long.

opening of 6½ by 7 inches. It is molded on a 48-oz. Watson-Stillman press because of the deep draw. To add the newspaper's names, tubes are then moved to a specially constructed hot stamping press. Peerless weather-resistant hot stamp foil is fed into the press over the tube side. Under the heat and pressure, the non-fading, corrosion-resistant paint is transferred to the tube. Since it is literally burned into the side of the PermaTubes, the legend will withstand anything to which the tubes themselves are subjected.

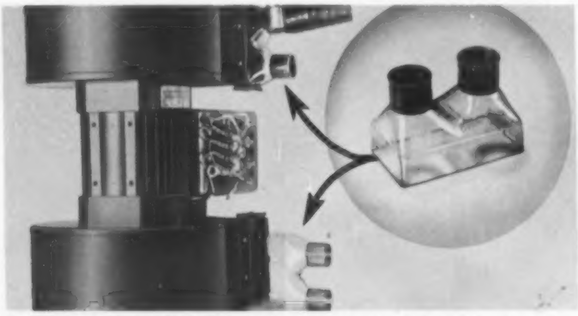
Electrical connectors

From England comes a male-and-female plug assembly that features fully interchangeable plastic components, alleviating the inventory problems of the manufacturer. The plug—male or fe- (To page 165)

NOW TWO GENERAL ELECTRIC GIVE YOU LEXAN THERMOPLASTICS



HOUSINGS OF LEXAN thermoplastic protect riding lights on the trailing edges of Lockheed's F-104 Starfighter. The transparent resin withstands high friction caused by speeds of 1500 mph, thanks to its exceptional resistance to wear and heat. The material can take high-altitude cold. (Housings molded by Crescent Mold Engineering Corp., N. Hollywood, Calif.)



BLOWER COUPLINGS for radar unit are tough, flame-resistant . . . give smoother air flow than could formerly be obtained with brass fittings. Fabricated of LEXAN polycarbonate resin, they withstand cycling from −54°C to +54°C under humid conditions. They are inexpensively vacuum-formed, allowing considerable savings in machining costs. (Used by the Tracking and Acquisition Radar Equipment Section of General Electric Company, Syracuse, N. Y.)

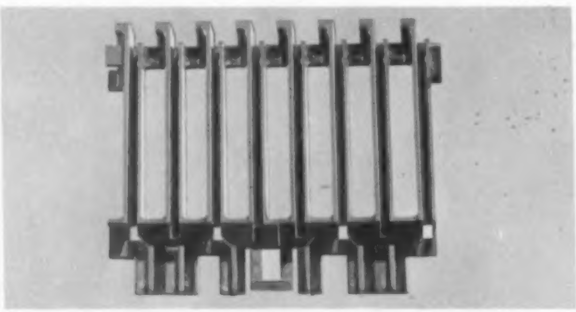
G. E. OPENS NEW LEXAN PLANT

Now, only G.E. offers two-plant flexibility in polycarbonates—a commercial plant and a semi-works plant for continued research and development in polycarbonate resins. The new plant, at Mount Vernon, Indiana, meets the increasing demand for LEXAN resins. The additional capacity, amounting to millions of pounds per year, makes General Electric the largest supplier of polycarbonate resins in the United States!

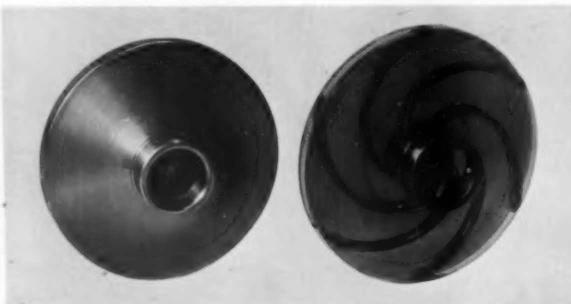
Pioneer in polycarbonates, G.E. has cooperated in the use of LEXAN resin in over 300 commercial applications. You can draw on this experience through G-E Technical Service. For a complete rundown on properties, uses, design considerations, molding and fabricating tips — send for LEXAN technical literature—the most complete literature on polycarbonates available! *(Coupon on page after next.)*

LEXAN —for designs that demand exceptional properties. If you want high strength and heat stability in a thermoplastic, use LEXAN polycarbonate resin. So tough is this material that it can actually be cold-formed and coined like a metal. It withstands over 12 foot-pounds per inch of notch—an impact strength attained by no other plastic. At the same time, LEXAN resin gives you a heat distortion point as high as 290°F! These properties are combined with outstanding dimensional stability, low water absorption, good electrical characteristics and other advantages.

LEXAN resin can be injection molded, extruded, vacuum formed, machined and bonded. It can be made into high-precision moldings, sheet, rod, tube, filament.

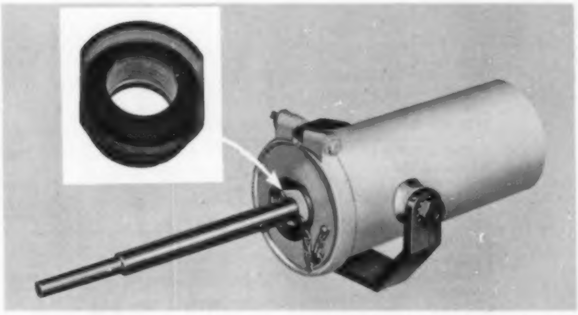


CARD GUIDE requires molding to close tolerances and minimum change in dimensions during service. Molded of LEXAN resin, the part shows excellent dimensional stability under varying conditions of moisture and at high temperatures. LEXAN resin is self-extinguishing—important in this application. (Molded for International Business Machines Corp. by Consolidated Molded Products Corp., Scranton, Pa. and Quinn-Berry Corp., Erie, Pa.)

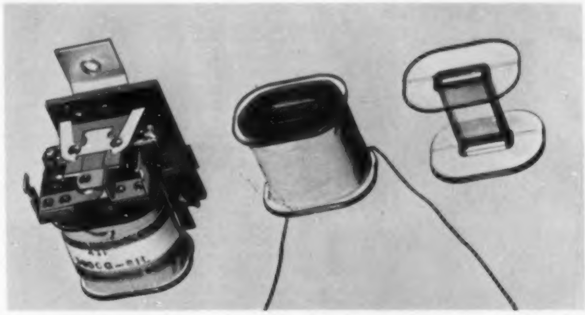


IMPELLERS molded of LEXAN resin replace bronze in jet pumps. Outperforming metal, LEXAN resin gives exceptional impact strength plus ability to withstand 280°F without distorting. LEXAN impellers withstant abrasive wear better than bronze and are unaffected by water or dilute acid. Impeller halves can be separately molded and then solvent-cemented. (Molded for Sta-Rite Products, Inc., Delavan, Wis. by Modern Plastics Corp., Benton Harbor, Michigan, and Santay Corp., Chicago, Ill.)

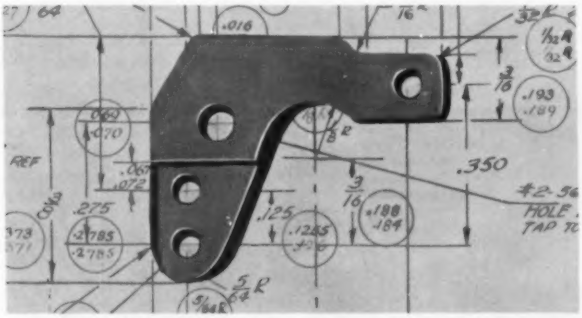
POLYCARBONATE PLANTS TO SOLVE PROBLEMS LIKE THESE



EMERGENCY-BRAKE BUSHINGS of LEXAN resin help trucks come to a safe stop. Before LEXAN bushings were used, the hole for the piston at the end of the activating cylinder quickly wore oblong, allowing road dirt to enter and cause leakage of the inner seal. The plastic's resistance to wear, heat and grease makes it ideal for this critical use. (Brake manufactured by MGM Brakes, Inc., Cloverdale, Calif. Bushings by Automatic Plastic Molding Co., Berkeley, Calif.)

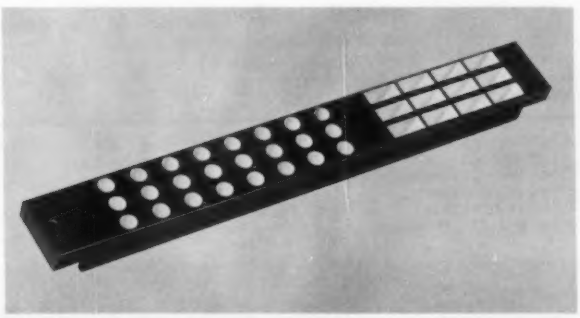


COIL FORM must not distort at temperature above 200°F under stresses caused by tightly wound wire. LEXAN resin provides heat distortion temperatures of 280-290°F under load. A good dielectric, LEXAN resin is resistant to oxidation at high temperatures and is non-corrosive even when used with very fine Class F magnet wire. (Molded for Sigma Instruments, Inc., So. Braintree, Mass. by Waterbury Companies, Inc., Waterbury, Conn.)

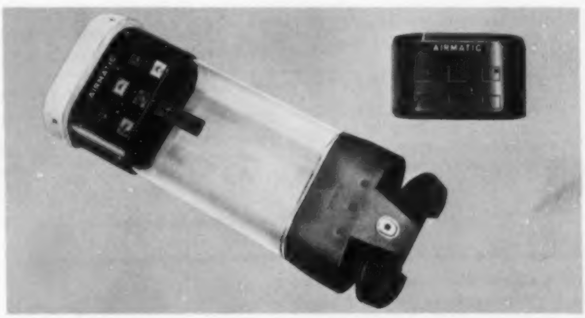


INSULATOR BLOCK of LEXAN resin helps insure trouble-free performance of electrical counter. Not much bigger than a dime, the part must maintain severe tolerances. It takes −85° to +280°F without distortion. The dimensional stability of LEXAN resin lowers cost of the part, permits replacement of materials which required costly machining to attain accurate dimensions. (Molded by Fred Knapp Engraving Co., Racine, Wis., for Abrams Instrument Corp., Lansing, Mich.)

FUSE HOLDER CAPS make use of the transparency and heat resistance of LEXAN polycarbonate resin. Lamp shining through LEXAN cover indicates blown fuse. Plastics previously used softened under the high temperature encountered in naval equipment. LEXAN resin was also selected for its good dielectric properties in the holder, which is rated up to 600 volts and 60 amps. (Molded by B&B Plastics, Oakville, Conn. and Engineered Plastics, Inc., Watertown, Conn. for Fuse Indicator Corp., Boston, Mass.)



LAMPHOLDER TERMINAL BLOCK is used inside electronic equipment where heat is difficult to dissipate. LEXAN polycarbonate resin replaced another thermoplastic which melted under severe thermal conditions. The part is molded with black resin and painted white in the lampholder holes. (Molded by Booker & Wallestad, Minneapolis, Minn. for Remington Rand Univac Div. of Sperry Rand Corp., St. Paul, Minn.)



"WARHEADS" for pneumatic tube systems take advantage of the high impact strength and dimensional stability of LEXAN resin. The good electrical properties of the thermoplastic permit placement of all electrical control elements in the head. LEXAN resin resists wear and tear and saves cost of repair and replacement in these parts, which undergo friction at speeds as high as 20 mph. (Molded for Airmatic Systems Corp., Saddle Brook, N. J. by Berkeley Engineering and Manufacturing Co., Berkeley Heights, N. J.)

PROPERTIES OF LEXAN POLYCARBONATE RESIN

	Property	Value	A.S.T.M. Test
PHYSICAL PROPERTIES	Color	Light amber, transparent	—
	Specific gravity	1.20	D 792
	Odor	None	—
	Taste	None	—
	Refractive index at 25°C	1.586	—
	Rockwell hardness	M70, R118	D 785
	Abrasion resistance, Taber abraser with CS-17 wheel	7–11 mg/1000 cycles	D 1044
	Impact strength, notched Izod, ⅛" specimen	12–16 ft-lb/in. of notch	D 256
	Impact strength, unnotched Izod, ⅛" specimen	>60 ft-lb/in.	D 256
	Tensile-impact	600–900 ft-lb/cu in.	—
	Tensile yield strength	8,000–9,000 psi	D 638
	Tensile ultimate strength	9,000–10,500 psi	D 638
	Tensile modulus	320,000 psi	D 638
	Elongation	60–100%	D 638
	Compressive strength	11,000 psi	D 695
	Compressive modulus	240,000 psi	D 695
	Flexural strength	11,000–13,000 psi	D 790
	Flexural modulus	375,000 psi	D 695
	Shear yield strength	5,400 psi	D 732
	Shear ultimate strength	9,200 psi	D 732
	Light transmission (⅛ in. thick disc)	75–85%	—
	Water vapor permeability	3–4 x 10^{-8} g/cm/hr/cm²/mm Hg	—
	Nitrogen permeability	0.012 x 10^{-8} cc(STP)/mm/sec/cm²/cm Hg	—
	Carbon dioxide permeability	0.32 x 10^{-8} cc(STP)/mm/sec/cm²/cm Hg	—
	Bulk factor of pellets	1.7	—
	Poisson's ratio	0.38	—
	Modulus of rigidity	116,000 psi	—
	Deformation under load, 4000 psi 77°F	0.2%	D 621
	158°F	0.3%	
	Fatigue endurance limit (Wohler method), 1800 cycles/min., 73°F, 50% RH	2000 psi	
	Water absorption, 24 hr. immersion	0.2%	D 570
	equilibrium 73°F	0.35%	
	equilibrium 212°F	0.58%	
THERMAL PROPERTIES	Heat distortion temperature	264 psi: 280°–290°F 66 psi: 283°–293°F	D 648
	Mold shrinkage	0.005–0.007 in./in.	D 955
	Thermal conductivity	4.6 x 10^{-4} cal/sec/cm²/°C/cm	—
	Coefficient of linear thermal expansion	3.9 x 10^{-5} in./in./°F	D 696
	Flammability	Self-extinguishing	D 635
	Brittle temperature	<−135°C	D 746
	Specific heat	0.30	Bulletin 157

Deformation under load on 0.5 in. cube	Temp., °F	Load, lb	Deformation, %	A.S.T.M. Test
	158	1000	0.282	D 621
	158	500	0.080	
	77	1000	0.220	
	77	500	0.101	

ELECTRICAL PROPERTIES

	−30°C	−3°C	23°C	100°C	125°C	A.S.T.M. Test
Dielectric constant						
60 cycles	3.12	3.14	3.17	3.15	3.13	D 150
10^6 cycles			2.96			D 150
Power Factor						
60 cycles	0.005	0.004	0.0009	0.0009	0.0011	D 150
10^6 cycles			0.010			D 150
Volume resistivity, ohm-cm	>10^{17}	>10^{17}	2.1 x 10^{16}	2.1 x 10^{15}	2.7 x 10^{14}	—
Arc resistance,						D 495
stainless steel strip electrodes			10–11 sec			
tungsten electrodes			120 sec			

	25°C	100°C	
Dielectric strength, short time	3,910 v./mil at 1.5 mils 3,080 v./mil at 3.0 mils 2,560 v./mil at 4.7 mils 1,130 v./mil at 23.0 mils 400* v./mil at 125.0 mils	3,380 v./mil at 3.0 mils 1,250 v./mil at 23.0 mils 600* v./mil at 125.0 mils	D 149
Resistance to electron beam radiation	No change up to 5 x 10^7r dosage		

*(*The step-by-step values are essentially the same as the short time values for the 125-mil pieces)*

Chemical Materials Department, Section MP-1
General Electric Company, Pittsfield, Mass.

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Never before has there been a pigment like ONCOR® 23A, developed especially for compositions based on halogenated resins. This pigment is composed of an inert silica core of low specific gravity, and has a surface layer of antimony oxide fused to the core.

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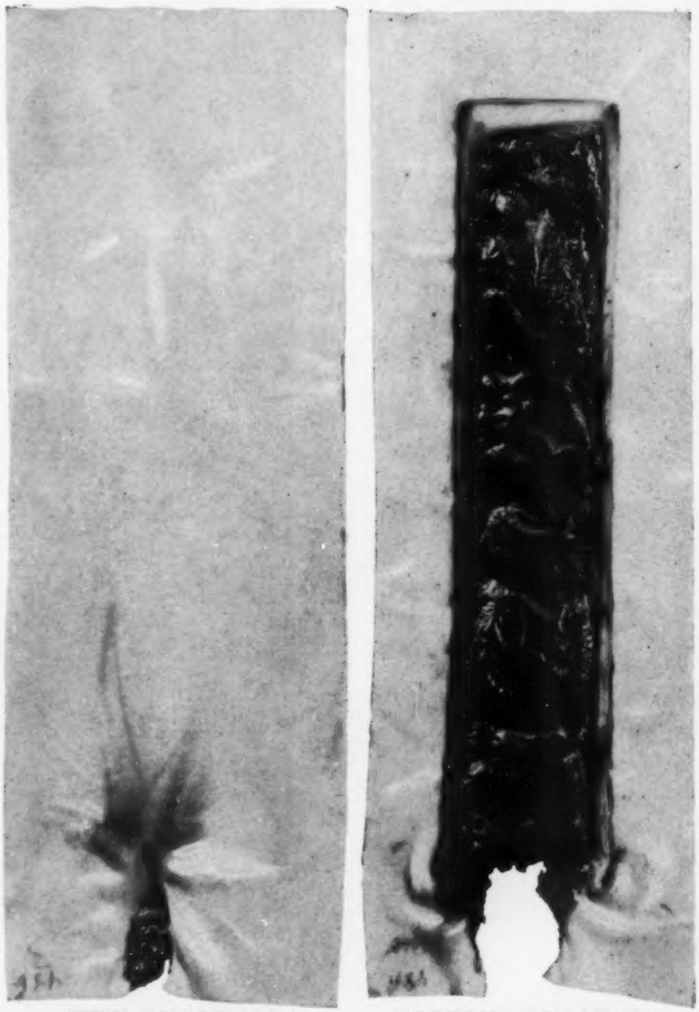
1. **Effective Flame Retardance** – ONCOR 23A pigment compares favorably with conventional antimony oxides in flameproofing efficiency in halogen-containing resins for plastics and paints. In tests on vinyl films, ONCOR 23A pigment has given equivalent flame resistance compared to conventional antimony oxide, on an equal weight basis.
2. **Low Tinting Strength** – ONCOR 23A pigment has a low and uniform tinting strength. In vinyl film tests, tinting strength consistently measures between 60% and 65% of a conventional antimony oxide standard. This allows most effective use of colorants.
3. **Low Specific Gravity** – Because of its special physical structure, ONCOR 23A pigment has a lower specific gravity than regular antimony oxides. This means a higher volume yield per pound of pigment.
4. **Excellent Dispersion Characteristics**—as a result of careful production controls, ONCOR 23A pigment has a particularly uniform particle. This assures consistently good dispersion in both plastics and paints.

ONCOR 23A pigment is suggested for use in all halogenated plastic and paint compositions requiring flame resistance. It may be used with polyvinyl chloride, vinyl chloride copolymers, chlorinated paraffins, chlorinated rubber, chlorosulfonated polyethylene, chlorinated polyesters and the commercial fluoropolymers.

Additional information on the new ONCOR 23A pigment is provided in the National Lead Company Data Sheet just off the press. The handy coupon at the right will bring you a copy by return mail.



WITH ONCOR 23A **WITHOUT ONCOR 23A**

These two samples show typical flammability test results on vinyl film, following the procedure specified in ASTM D-1433-58. (See Item 1 in text.)

KC-6295

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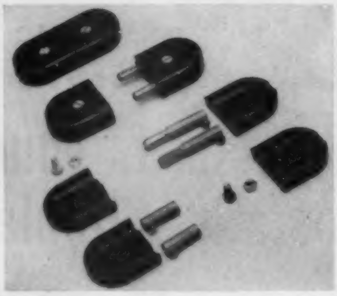


MOLDED high-density polyethylene plug and socket assembly, showing the components (bottom) that make up the complete unit (top).

male—consists of a molded high-density polyethylene housing, with molded-in recesses to accommodate the metal prongs or "sockets." The housings are produced in two identical parts by McMurdo Instruments Ltd., Ashtead, Surrey, England, of Rigidex polyethylene supplied by British Resin Products Ltd., London. In final assembly, the sockets are held together by a single screw and nut.

Clampless cable harness

Of late, plastics have found increasing use in bundling cable and wire—as straps, clamps, ties, and the like. Now comes a method that eliminates taping, lacing, and other mechanical means of gathering wires together: shrinkable vinyl tubing.

The wire assembly to be harnessed is encased in the tubing and then "cured." Cure can be affected in an oven (preferably air-circulating) or by heat lamps at temperatures of 250° F. (20 min.) or 275 to 300° F. (3 to 8 min.). Shrinkage of the tubing is up to 30% in diameter and 15% in length. Prices range from 0.036¢/ft. for tubing with 0.046-in. final ID, to 0.20¢/ft. for tubing with a final ID of 1.5 inches.

The sleeving is supplied by Foley Electronics Co., College Park, Md. using vinyl tubing extruded by Irvington Div., Minnesota Mining & Mfg. Co., Irvington, N. J.

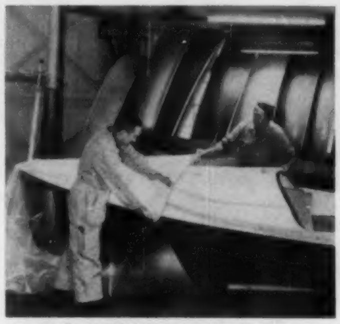
The new harnessing technique is said to combine the advantages of tape and tough insulated sleeving; cuts the cost of assemblies and harnesses. Tubing is available in continuous and special lengths.

PE film finds new outlets

Product protection, cost savings, and better materials handling—these are among the potent reasons leading to ever new markets for polyethylene film. The applications described below do not at the present time represent outlets comparable in volume to packaging, but they have a healthy potential.

Boat "cocoon"—Small-boat manufacturers have found in PE film the solution to one of their vexing problems: keeping the craft clean on the way to the dealer to eliminate the necessity for scrubbing them before they reach the showroom. They simply slip the boat into a tube of 4-mil blown PE film. Two companies currently shipping boats wrapped in this manner are O'Day Mfg. Corp., Fall River, Mass., and The Anchorage Inc., Warren, R. I. Both companies use Durethene film made by Koppers Co. Inc. The film is 8 ft. wide and comes in continuous lengths for tailoring to the boat size. Cost per square foot is about 1¢; for 16-ft. boats, this comes to approximately $2. While costs of boat maintenance and cleaning will vary from location to location, they generally exceed the $2 figure. An additional bonus is the fact that the boats can be safely kept outdoors until sold.

Ingot protection—One-ton bundles of aluminum ingot are stored in PE film at the Alton, Ill. plant of Federated Metals Div., American Smelting & Refining Co. By **(To page 166)**



PE FILM TUBING (above) is slipped over 16-ft. boat at O'Day Mfg. Corp. prior to shipment to dealer. Aluminum ingot bundles (below) are stored in PE film.

controlling moisture condensation on the metal and preventing dirt and dust contamination, the film bags help ensure delivery of shiny, unblemished metal to the customer.

The bags, of 4-mil film, are produced by Bemis Bro. Bag Co., and sell at 77¢ each in lots of 1000. They are formed of Bakelite PE supplied by Union Carbide Plastics Co.

Giant epoxy carrier

One of the largest epoxy-reinforced plastic containers ever built is Union Carbide Plastics Co.'s experimental cargo carrier, 24 ft. long, 8 ft. wide, and 8 ft. high, with a payload capacity of 40,000 pounds. Designed for bulk shipment of dry resins, the carrier is said to be rigid, resist abrasion and corrosion, and ¼ lighter than aluminum equivalents.

Epoxy-glass fiber is applied with spray gun over heavy cardboard, which forms the core for corrugated walls and ceiling; floor panels are built on an aluminum core. Panels (4 by 8 ft.) are then bonded to a steel frame. Carriers may be stacked five high and their construction allows a tilt of 60° for easy discharge of contents.

. . . And in brief

• New 2-in. polyethylene drum faucet, called the Flo-King (Jumbo), has been introduced by Multi-Meter Corp., Toledo, Ohio. Faucet is said to empty a 55-gal. drum of average material in a little over 2 min. at full flow. Overall length is 6 in. in closed position and the weight is 9 oz.; fits all standard 2-in. steel shipping container openings.

• A note of style is added to Hedstrom tricycles with pedals molded of polyethylene in colors to match the finish of the frame. Pedals molded by Joseph P. Miller Co. Inc., Leominster, Mass., for Hedstrom Union Co., Fitchburg, Mass., using Tenite polyethylene supplied by Eastman Chemical Products Inc.

• Seven-oz. disposable hot-drink cup is made of two plies of impact polystyrene, the outer ply being foamed to provide exceptional insulation and to prevent discomfort for the user. Manufacturer is Scott Paper Co., Chester, Pa.

• Aluminum level with I-beam frame has pre-adjusted vials protected by special holders made of injection molded transparent Plexiglas acrylic plastic. A special epoxy resin "cements" the vials to the holders. Level developed by Johnson Products Co., Milwaukee, Wis.—**End**

Photo courtesy Bergen Evening Record, Hackensack, N. J.

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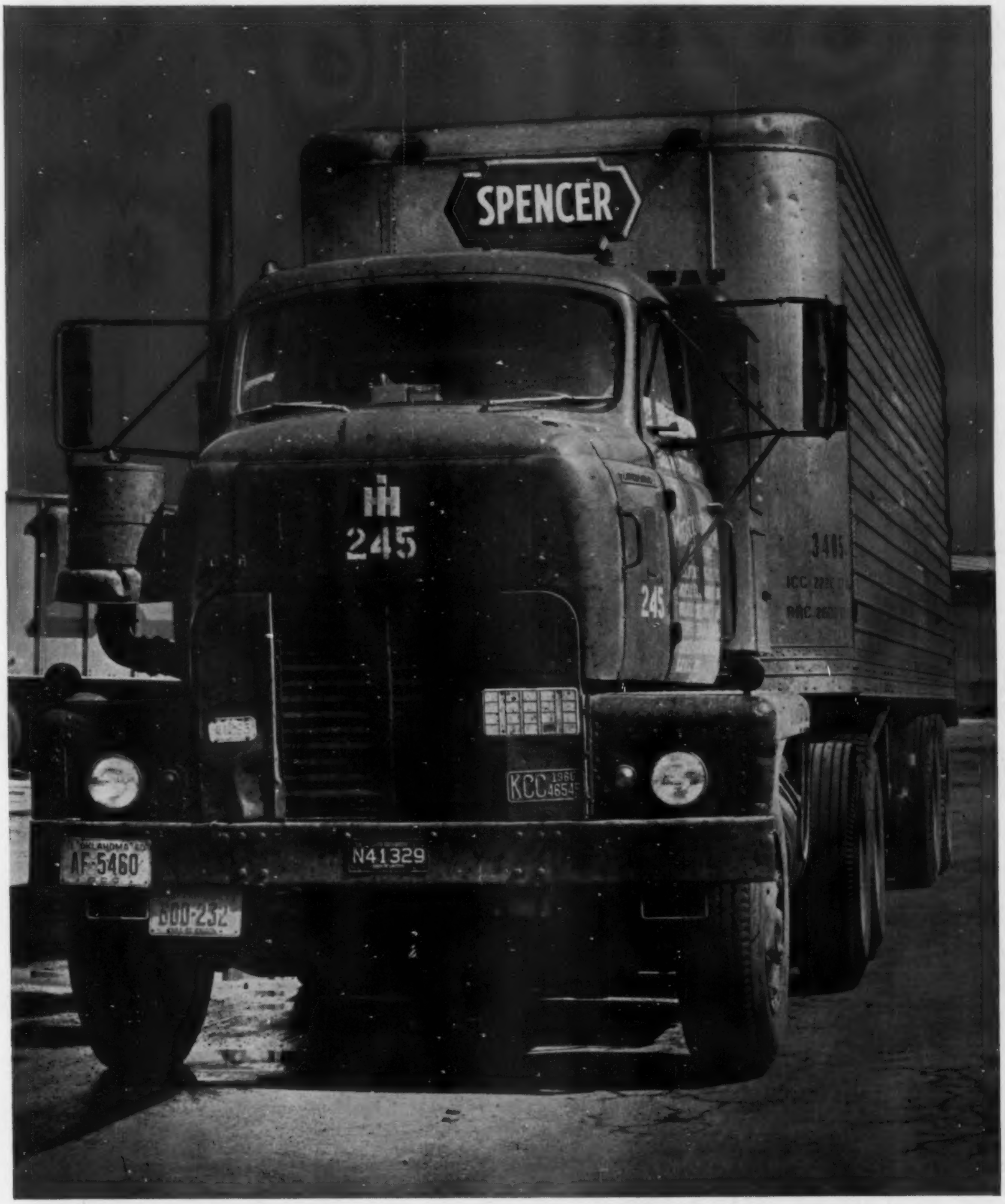

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LITERATURE

Write for these publications to the companies listed. Unless otherwise specified, they will be sent gratis to executives who request them on business stationery.

"Die Kunststoffe—Eine Einfuhrung in ihre Chemie und Technologie" (Plastics—An Introduction to their Chemistry and Technology) *by Dr. Georg Schulz.*

Published in 1959 by Carl Hanser Verlag, 22 Kolbergerstrasse, Munich 27, Germany. 536 pages. Price: 49 DM (about $11.80). In German.

A first text on the nature and use of plastics. The book includes an elementary but thorough discussion of the basic chemistry of polymers, processing methods, and types of plastic applications. Included is an extensive appendix containing a bibliography, tradename guide, and a list of important periodical literature sources. For those who read German, a good chance to get the European point of view.—*G.R.S.*

How to Proceed Under the Food Additives Amendment is a manufacturers guide to legal and technical considerations presented by this 1958 amendment, backbone of which is to make pre-testing of food additives a legal requirement. 12 pages. Price: 50 cents. *Manufacturing Chemists' Assn. Inc., 1825 Connecticut Ave., N. W., Washington 9, D. C.*

Plastic Extrusions outlines available production and engineering facilities, and include a selection guide to thermoplastic compounds. 12 pages. *Jessall Plastics, Kensington 4, Conn.*

"Engineering Data Chart of Thermosetting Laminated Materials Showing Principal Grades and Properties." Description; applications; characteristics; and mechanical, electrical, physical, and thermal properties of phenolic, silicone, melamine, and epoxy. 4 pages. *Comco Plastics Inc., 98-34 Jamaica Ave., Richmond Hill 18, N. Y.*

"Plastics for Architects, Artists, and Interior Designers." Comprehensive survey illustrates applications of plastics in the building and decorating fields. Includes glossary of terms and lists designers, associations, and publishers in the plastics industries. 52 pages. Price: $2.00. *Society of Plastics Engineers Inc., 65 Prospect St., Stamford, Conn.*

Spray painting masks. "Electro-Formed Spray Painting Masks for Mass Production Color Decoration" describes the four basic mask classifications available—lip mask for sunken design, lip mask for capping raised design, plug mask, and block cut-out plane surface mask—as well as pressure fixtures and handling devices. Masks of up to 69 in. in length are offered. 4 pages. *Conforming Matrix Corp., Factories Bldg., Toledo 2, Ohio.*

Penton for Corrosion Resistance. Wall chart gives the resistance of Penton to many typical chemicals at various temperatures. 11 by 20 inches. *Cellulose Products Dept., Hercules Powder Co., Wilmington 99, Del.*

Foaming in Place with Rigithane 334 Foaming Resin gives typical physical properties, chemical resistance, viscosity characteristics, stress *vs.* strain relationships, mixing techniques, process variables, molding and foam-in-place data, applications, safety precautions, etc. 22 pages. *Thiokol Chemical Corp., 780 N. Clinton Ave., Trenton 7, N. J.*

AccuRay Extruder Measurement and Control Systems. Describes methods of measuring and automatically controlling the significant thickness variables of extruded plastics: 1) long-term machine direction variations; 2) short-term machine direction variations; and 3) profile variations. Recommends systems used to control extruded blown film, flat die extruded film and sheet as well as extruded coatings. Bulletin PL-560. 12 pages. *Industrial Nucleonics Corp., 650 Ackerman Road, Columbus 2, Ohio.*

Adhesives. Characteristics, types, and principal uses for a line of adhesives for bonding plastics, metals, fabrics, leather, glass, and wood products to themselves or in combination. 4 pages. *Bostik Adhesives, B. B. Chemical Co., 784 Memorial Dr., Cambridge, Mass.*

Plastics Fact File is a revised edition of a booklet describing the properties and typical end uses for the company's line of plastic materials. Includes results of ASTM tests on Lustrex styrene, Monsanto PE and Opalon vinyl chloride molding compounds; general information about the forms, typical uses, and characteristics of the line of fabricating, extruding, calendering, and laminating materials, as well as industrial, textile, surface and paper coating resins, adhesives, and intermediates. 12 pages. *Monsanto Chemical Co., Springfield 2, Mass.*

Stripping compounds and cleaners. Specifications, prices, uses, etc., for Meta-Strip 702 Liquid and Meta-Strip 702 Gel, which are synergistic, non-corrosive solvents for removal of cured epoxy, polyester, and similar resin compounds. 2 pages. Similar data for Meta-Terge 1405 Gel, a clean-up detergent for uncured epoxy resin compounds, greases, printing inks, etc. 2 pages. *Metachem Resins Corp., 530 Wellington Ave., Cranston, R. I.*

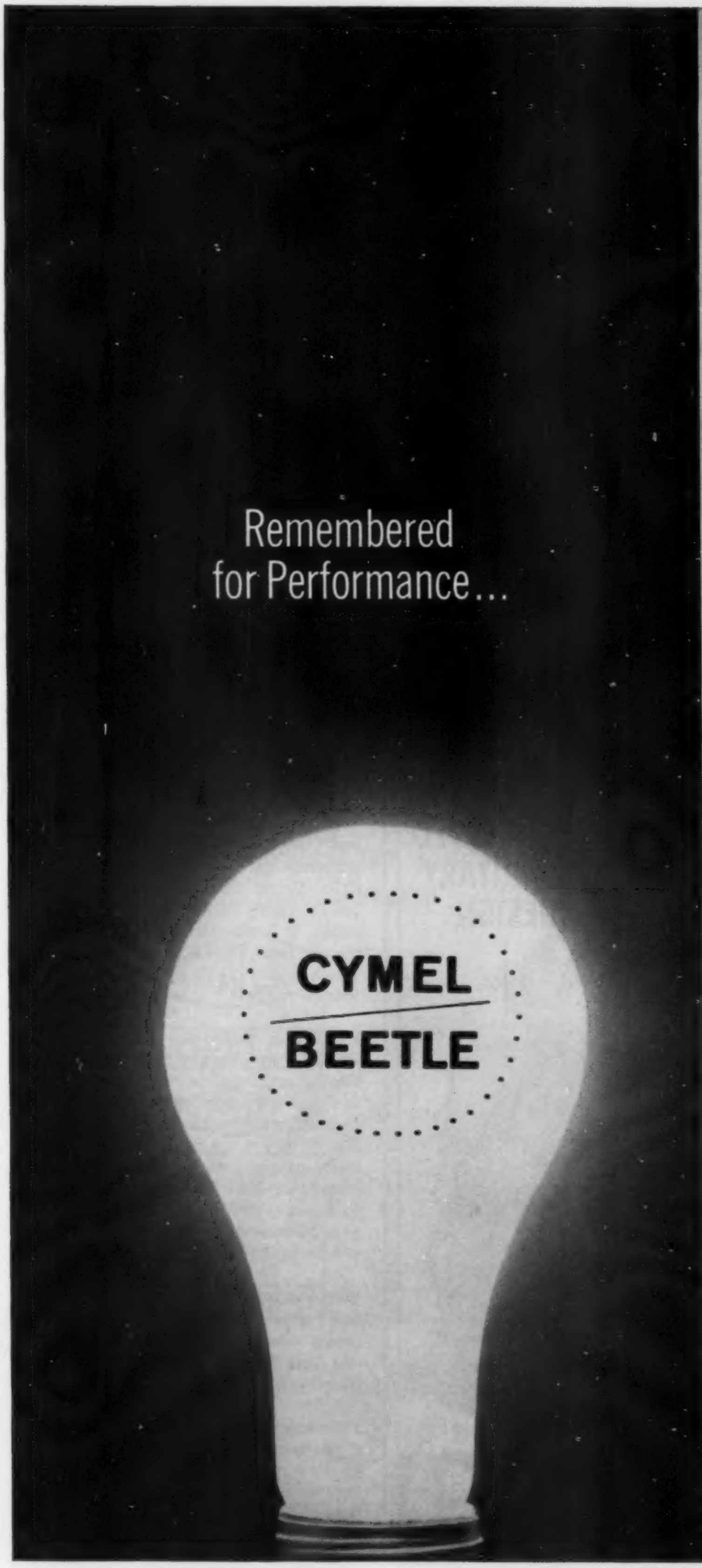
Resin kettle reactor. Features, specifications, uses, etc., for a line of synthetic resin kettle reactors for producing resins, plastics, adhesives, varnishes, and bodied oils. Company can fabricate complete resin plants —plus condenser, decanter-receiver, thinning tank, heating plant, and control board—in sizes ranging from 500 to 10,000 gallons. 8 pages. *Brighton Corp., 820 State Ave., Cincinnati 4, Ohio.*

Epoxies. Advantages and uses for 15 epoxy-based products, including the new H-F line of Centennial Enamels. 4 pages. *Howe & French Inc., Weymouth 88, Mass.*

Metallic bronze powders. Color card shows printed samples of the 44 in-stock metallic bronze powders currently available, and describes the features and uses for this line of pigments. 8 pages. *Crescent Bronze Powder Co., 118 W. Illinois St., Chicago 10, Ill.*

Coatings Selector for Plastics, Metal, Glass, and Wood is a wall chart for the selection of coatings for the listed materials. Similar chart is oriented to base, top, and back-up coatings for use with vacuum metallizing. 25 by 11 inches. *Logo Div., Bee Chemical Co., 2700 E. 170th St., Lansing, Ill.*

Rules of Radiation Infra-Red Sources. Bulletin discusses infra-red source theories and laws; prediction of quantity and quality of radiation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from heated sources; color blindness; etc. Technical Bulletin 59-220. 8 pages. *Infra-Red Div., Fostoria Corp., Fostoria, Ohio.*

Fibrous glass-reinforced polyester shapes. Bulletin gives engineering dimensions and suggested applications for 10 sizes of insulating channel and angle stock. 6 pages. *The Glastic Corp., 4321 Glenridge Rd., Cleveland 21, Ohio.*

Portable water chillers. Specifications, features, prices, etc., for a line of 1½-, 3-, and 5-hp. portable water chillers with thermostats adjustable from +90 to +20° F. 4 pages. *Injection Molders Supply Co., 3514 Lee Rd., Cleveland 20, Ohio.*

Gaging instrumentation. Features, uses, etc., for a line of electronic devices for measuring, indicating, recording, and controlling dimensional change. Catalog G-100. 4 pages. *Measurement Control Devices, P. O. Box 505, Camden, N. J.*

Fire-safety of plastics for building. "A Study of Fire-Safety Aspects of Plastics in Building Construction," which was prepared by the Southwest Research Institute, San Antonio, Texas, under the aegis of MCA, reviews the fire protective function of building elements and the fire safety provisions of building codes in relation to the use of plastic building materials. The report finds that present building codes actually permit more plastics than are currently being used, but that much still remains to be done by the building industry towards better understanding of the nature of plastics. 108 pages. Price: $5.00. *Manufacturing Chemists' Assn., Inc., 1825 Conn. Ave., N. W., Washington 9, D. C.*

Motor selection guide. Pocket-size card provides quick reference to frame size (182 to 445U) and book price for a.c. motors from ¾ to 125 horsepower. Motors are 3-phase, 60-cycle, for 208-220/440 or 550 volts. *General Electric, Schenectady, N. Y.*

Injection molding machines. Features, specifications, installation data, etc., for a line of injection molding machines. Includes data on typical moldings. 18 pages. *O. Florin Ltd., 88/90 Holloway Rd., London N7, England. U. S. agent: Gilbert Rogers, 1011 S. Maple St., Freeport, Ill.*

TFE-fluorocarbon shapes and parts. Describes complete line of Polypenco Teflon stock shapes and fabricated parts, together with mechanical, thermal, electrical, and chemical properties for TFE-fluorocarbon resins. One section deals with Fluorosint, a new TFE-fluorocarbon base composition. Bulletin BR-4. 8 pages. *The Polymer Corp. of Pennsylvania, Reading, Pa.*

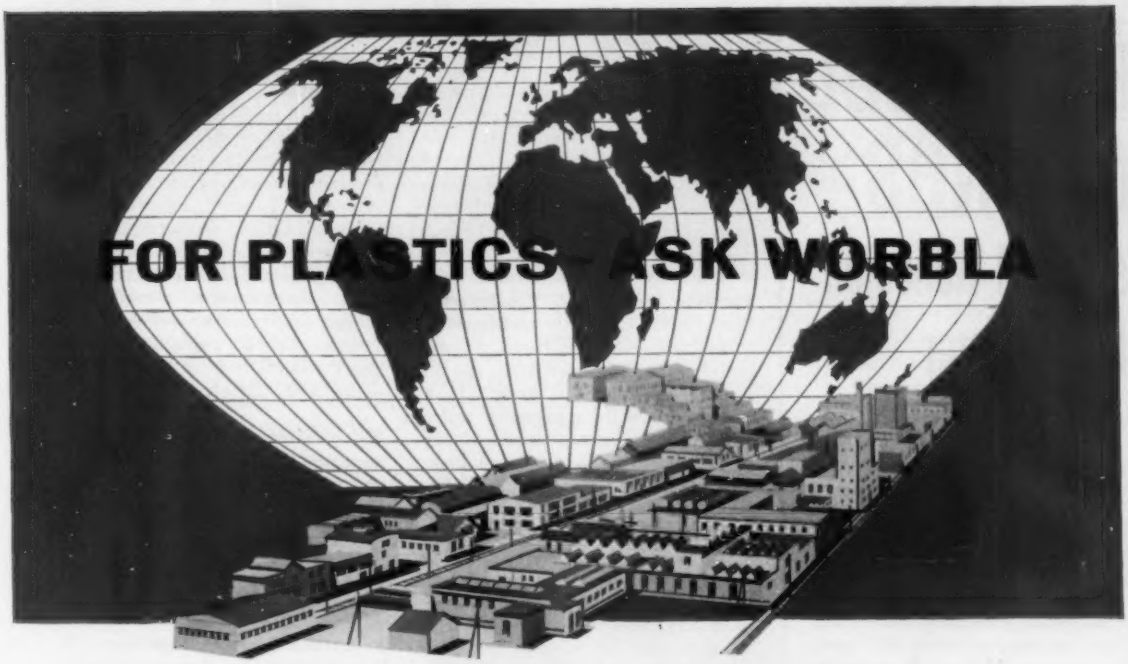
Expanded polystyrene insulating blocks. Insulation properties, U-factor table, heat loss data, etc.; directions for use as an insulation plaster base, as shingle backer, as cavity wall insulation, roof insulation, perimeter insulation, and in flotation applications, for a line of Cellulite expanded polystyrene insulating blocks. 6 pages. *The Gilman Bros. Co., Gilman, Conn.*

Barrel finishing. "The Quicklustre #104 Wax Process for Low-Cost, Attractive Finishes" explains a method developed for imparting lustrous or glossy finishes to items not expected to retain their sale finish for a long period of use. Bulletin TPB-2. 2 pages. "Finishing Plastic Buttons with Tumb-L-Matic's DL Process" outlines procedures to be followed for the removal of shear marks, concavity, and surface defects from raw button blanks. Bulletin TPB-4. 2 pages. "No Wax, High Lustre Finishes with the DL Process" deals with the process developed for achieving color, lustre, and texture comparable to that achieved by hand buffing. 2 pages. "The Barrel Finishing of Resistor Leads" offers information on preparation of leads prior to tin electroplating and hot dipping. 1 page. *Tumb-L-Matic, 39 St. Mary's St., Stamford, Conn.*

Production facilities. Bulletin describes the engineering design fabrication, molding, and extrusion facilities available from this manufacturer and distributor of Teflon, Kel-F, nylon, phenolic, and other fluorocarbon products. Includes properties and applications of Teflon TFE and 100-FEP. 4 pages. *Industrial Plastics & Equipment Co. Inc., 477-50 Main St., Orange, N. J.*

Magnetic inks. Color book illustrates new magnetic inks available in green, brown, and maroon. *Sinclair and Valentine Co., 611 W. 129th St., New York 27, N. Y.*

Pyrometer. Features, uses, etc., for a portable one-probe pyrometer, which is used for determining temperatures of surfaces, ovens, and fluids, and is applicable for heat sealing, plastic forming and sealing, etc. 2 pages. *Electronic Development*



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"Perforating, Slitting, and Blanking." Catalog outlines this company's facilities for performing these operations on all types of flexible materials, rigid sheets, and foam; discusses suggested applications and materials, and shows a large number of die patterns in actual size. Catalog 60. 22 pages. *Perforating Industries Inc., 606 Commerce Road, Linden, N. J.*

Polyester resins. "A Comparative Study of the Corrosion Resistance of a Bisphenol Polyester Resin, a General-Purpose Polyester Resin and an Isophthalic Polyester Resin" is a report on how three polyester resins withstood a 6-month immersion in various corrosive aqueous solutions at elevated temperatures. 12 pages. *Atlas Powder Co., Chemicals Div., Wilmington 99, Del.*

Vacuum Coating and Equipment is a detailed study of vacuum coating, its history, uses, discussion on coating units available, services available from the firm, etc. Bulletin 2-2. 28 pages. *Consolidated Vacuum Corp., 1775 Mount Read Boulevard, Rochester 3, N. Y.*

Diallyl phthalates. Property chart lists electrical, structural, thermal properties and other data on regular and flame-retardant diallyl phthalate and diallyl isophthalate plastics. Includes military specs. 2 pages. *Mesa Plastics Co., 12270 Nebraska Ave., Los Angeles 25, Calif.*

Rigid vinyl sheet. Light stability, fire resistance, light transmission, design flexibility, installation data, specifications, testing methods, etc., for VCA-3606, a high-impact rigid vinyl material for luminous ceiling diffusers and other lighting fixture applications. Technical Release 8. 4 pages. *Union Carbide Plastics Co., 30 E. 42nd St., New York 17, N. Y.*

"A Guide to U. S. Indexing and Abstracting Services in Science and Technology." Index of abstracting, indexing, and title-announcement services originating in the United States. Report No. 101. Price: $2. 80 pages. Prepared by the Science and Technology Div., Library of Congress, for the *National Federation of Science Abstracting and Indexing Services, 301 E. Capitol St., Washington 3, D. C.*

Tubes, rods, and sheets. Brochure describes applications and properties of Cadco cast acrylic rods and tubes; also gives available sizes and colors. 8 pages. *Cadillac Plastic & Chemical Co., 15111 Second Boulevard, Detroit 3, Mich.*

"Tables for Identification of Organic Compounds," a supplement to "Handbook of Chemistry and Physics," contains over 30,000 constants of organic derivatives arranged in 17 classes: alcohols, aldehydes, alkyl and aryl halides, amines, amino acids, aromatic hydrocarbons, carbohydrates, carboxylic acid anhydrides, carboxylic acid halides, carboxylic acids, ethers, ketones, nitriles, nitro compounds, phenols, quinones, and sulfonic acids. 256 pages. Price: $7.00. *The Chemical Rubber Co., 2310 Superior Ave., Cleveland 14, Ohio.*

Nylon fasteners. Brochure gives dimensions, blank sizes, thread sizes, etc., for a line of nylon and plastic-head fasteners, including hex nuts, miniature machine screws, thumb nuts, and rivets. 2 pages. *Gries Reproducer Corp., 400 Beechwood Ave., New Rochelle, N. Y.*

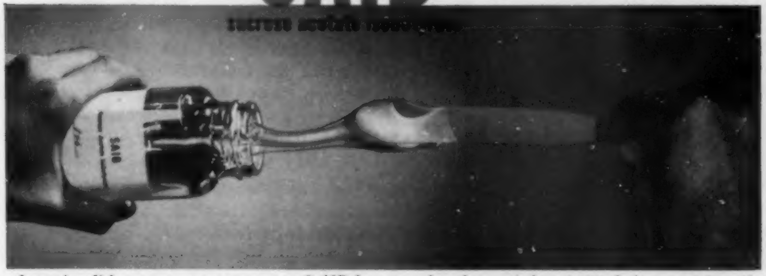
Production facilities. Brochure outlines production and research facilities, variety of products, etc., for a company that manufactures Orthoplene, Metaplene, and Paraplene cast PE films; Caplene nylon film; Proplene cast polypropylene film; and plastic-coated packaging and industrial materials. 8 pages. *Ludlow Corp., Needham Heights, Mass.*

Engraved and stamped products. Bulletin describes a line of engraved dials, scales, panels, data plates, signs, etc., that are made out of plastics and other materials. 3 pages. *J. S. Packard Inc., 200 Hudson St., New York 13, N. Y.*

Flexographic inks. Production features, performance characteristics, etc., for a line of Magnagloss one-solvent-reducible flexographic inks for printing on a variety of plastics film and other materials. Includes two samples of Magnagloss inks on treated PE film. Technical Bulletin 609. 4 pages. *Claremont Pigment Dispersion Corp., 39 Powerhouse Rd., Roslyn Heights, N. Y.*

Designer's Fact Book contains property and application data covering 70 standard, special, and molding grades of high-pressure thermosetting laminating plastics, military specs, a grade comparator chart, tolerance and weight specifications, etc. 115 pages. Also available is **Selector-Visualizer**, a pocket-size guide containing laminated plastic samples for signs, nameplates, and specialty

Unique function of SAIB aids plastics processors



A semi-solid at room temperature, SAIB has a molecular weight of 838. It is exceptionally light in color and unusually stable to ultraviolet light. SAIB exhibits outstanding hydrolysis and thermal stability. (Less than 0.1% is hydrolyzed after refluxing 96 hours with water. Heated to 175°C. for a period of 6 days, its color increases slowly to straw yellow, with no appreciable change occurring until after 24 hours of heat-aging.) SAIB is compatible with a wide variety of polymers, modifiers and plasticizers and is highly soluble in most common solvents. (A 90% solution of SAIB in ethyl alcohol has a viscosity of only 750 centipoises at 30°C.)

When used in conjunction with dimethyl phthalate and other common plasticizers, SAIB offers processors of cellulose acetate plastics the means of achieving

easier dry-blending
faster molding cycles
increased extrusion rates
improved physical properties

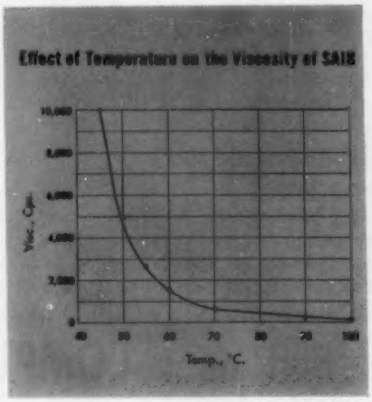
SAIB aids in dry-blending

SAIB deactivates the cold solvency characteristics of dimethyl phthalate and similarly-active plasticizers. By blending SAIB with the plasticizer before compounding, even distribution of the plasticizer throughout the cellulose acetate mix is readily accomplished, eliminating the problem of paste formation.

SAIB increases molding and extruding rates

The presence of SAIB in a plasticized cellulose acetate formulation permits faster, more uniform flow through extrusion and molding cylinders *without decreasing hardness or flexibility*.

As illustrated in the graph, SAIB has an extremely high temperature-viscosity index. Note that at 70°C., its viscosity is less than 1,000 centipoises. Below this temperature, however, a sudden increase occurs. At 50°C., its viscosity is approximately 4,500 centipoises. At room temperature, it becomes a semi-solid.



At molding or extrusion temperatures, SAIB aids in plasticization, while at room temperature it has the opposite effect, stiffening the plastic and increasing its surface hardness. This unique behavior of SAIB permits molding and extrusion conditions applicable to a material one or two flows softer than its hardness and rigidity at room temperature would indicate.

Similarly, in vacuum-forming, cellulose acetate sheeting formulated with a dimethyl phthalate-SAIB blend submits to deeper drawing before blushing occurs, again because of this unusual temperature-viscosity relationship.

SAIB improves physical properties

Modification of cellulose acetate formulations with SAIB increases hardness, rigidity and tensile strength, and decreases weight loss on accelerated aging.

Note that this improvement in physical properties achieved at practical flow temperatures is due to the behavior of SAIB and not to a decrease in plasticizer content. Dimethyl phthalate-SAIB formulations exhibiting physical characteristics in the range of H 5 or H 6 have been extruded without difficulty.

Hot melts, peelable coatings

With its excellent permanence, compatibility and stability characteristics, SAIB can be used to advantage in hot melt and peelable plastic formulations.

Tough, flexible melt coatings can be made containing up to 70% SAIB. One of their outstanding features is a complete absence of fuming at melt temperatures. Operating temperatures are lower, too. The usual application temperature for conventional butyrate hot melts is 350°F. With high SAIB modification, optimum operating temperature is only 275°F.

In ethyl cellulose compositions, SAIB acts as a solubilizer for mineral oil, reducing exudation of the oil from the film and enabling the formulator to use increased amounts of oil.

In peelable coatings, SAIB improves resistance to exudation, thus maintaining flexibility.

SAIB is so unusual—acting as a plasticizer under certain conditions, and as resin extender under others—you will want to try it in your own formulations, under your own processing conditions. You can get a sample of SAIB, as well as a technical report on its physical properties and performance, by writing to your nearest Eastman sales office or to EASTMAN CHEMICAL PRODUCTS, INC., subsidiary of Eastman Kodak Company, KINGSPORT, TENN.

SAIB

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items. Contains information on finishes, thicknesses, sheet sizes, properties, colors available, etc. *Formica Corp., 4550 Spring Grove Ave., Cincinnati, Ohio.*

PVC plasticizers. Performance properties vs. plasticizer concentration of polyvinyl chloride stocks, plasticizer requirements for typical end products, physical properties of neat plasticizers, and other technical data on the Paraplex and Monoplex plasticizers. Bulletin MR-20-60. 24 pages. *Rohm & Haas Co., Washington Square, Philadelphia 5, Pa.*

Sintered nylon parts. Formulations available, properties, applications, etc., for Nylasint parts, which are nylon wear components formed by cold pressing and sintering nylon powders. Bulletin BR-1111. 4 pages. *Halex Corp., Reading, Pa.*

"Blow molding: How to Obtain Highest Quality and Production Rate." Explains how changes in polyethylene resin properties and extrusion and molding factors affect the properties of blow molded items; notes that such properties as stiffness, stress crack resistance, and gloss are affected by resin density, melt index, extrusion melt temperature, blow pressure, die opening, etc. 8 pages. *U. S. Industrial Chemicals Co., 99 Park Ave., New York 16, N. Y.*

Polymeric plasticizer. Product specifications, typical properties, and uses for Hercoflex 900, a clear liquid polyester with the plasticizing effect of a monomer. Data Sheet 249. 1 page. *Hercules Powder Co. Inc., 900 Market St., Wilmington 99, Del.*

Adhesives, pastes properties chart. Includes information on epoxy adhesives, their application, cure times, and physical properties; test methods, application suggestions, and availability. Wall chart. *Furane Plastics Inc., 4516 Brazil St., Los Angeles 39, Calif.*

9th National Plastics Exposition. Brochure describes the forthcoming plastics show and S.P.I. National Conference, which will be held June 5-9, 1961, New York Coliseum. Includes tentative list of Exposition exhibitors. *The Society of the Plastics Industry Inc., 250 Park Ave., New York 17, N. Y.*

Strip coating and masking wax. Properties, application methods, etc., for Isochemwax 1812, a method of using strip coating for the temporary protection of wire leads, lugs, contact points, and other component parts during casting, potting, dipcoating, or embedment with epoxy resin compounds. 1 page. *Isochem Resins Co., 221 Oak St., Providence 9, R. I.*

Injection molding machines. Engineering data for a line of injection molding machines up to 1-oz. capacity, including specifications, features, capacity and pressure data, etc. 62 pages. *Newbury Industries Inc., Newbury, Ohio.*

Steam traps and temperature regulators. Specifications, capacities, features, etc., for a line of steam and drain traps, temperature regulators, pipeline strainers; heating system controls for molds, cylinders, as well as drums; etc. 12 pages. *Sarco Co. Inc., 635 Madison Ave., New York 12, N. Y.*

Thermosetting molding compounds. Physical, mechanical, and electrical properties; applications; etc., for Durez thermosetting phenolic and diallyl phthalate molding compounds, Durez phenolic bonding and coating resins, and Hetron fire-retardant polyester resins for RP laminates and molded shapes. 8 pages. *Hooker*

Chemical Corp., Durez Plastics Division, 8 Walck Rd., North Tonawanda, N. Y.

Injection molding machines. Five case histories show how Natco injection machines were used to mold: 1) polystyrene TV implosion shields; 2) acrylonitrile juicer bowls; 3) high-impact TV control panels; 4) butyrate carpet sweeper nozzles; and 5) polystyrene slide projectors. Bulletin 1001. *National Automatic Tool Co. Inc., Richmond, Ind.*

Benzoyl peroxide safety data. Data sheet outlines safety precautions relating to benzoyl peroxide, a white granular solid used largely as a catalyst in resin manufacture. Covers properties, hazards, engineering control of hazards, employee safety, fire fighting, handling and storage, and waste disposal. SD-81. Price: 30 cents. *Manufacturing Chemists' Assn., 1825 Conn. Ave., N. W., Washington 9, D. C.*

Films for extrusion coating and lamination. Durability, stability, and printability data; characteristics of substrates; barrier properties; applications; etc., for a line of films for extrusion coating and laminating. 8 pages. *E. I. du Pont de Nemours & Co. Inc., Wilmington 98, Del.*

Organic Solvents and Chemicals. Revised edition provides quick and detailed information on 150 chemical products, i.e., alcohols, amines, aliphatic naphthas, esters, glycols, ketones, plasticizers, polyethylene glycols, etc. Includes formulae for completely and specially denatured alcohols, table for gaging contents of drums, temperature conversion chart, and other data. 64 pages. *Chemical Solvents Inc., 60 Park Pl., Newark 2, N. J.*

Resin Guide. Physical, electrical, and chemical properties; descriptions; special features; uses; etc., for Vibrin polyester resins, Kralastic ABS compounds, and Marvinol PVC resins. 12 pages. *Naugatuck Chemical Div., U. S. Rubber Co., Naugatuck, Conn.*

Urethane foams. Brochure serves as a dual-purpose pictorial progress report and designer's fact file on industrial and commercial uses for urethane foams. Includes property and performance data relating to such uses as insulation, structural panels, missile components, industrial packaging, acoustical artifacts, void-filling and potting compounds, etc. 24 pages. *Mobay Chemical Co., Pittsburgh 5, Pa.*—**End**

Plastics Digest

(From pp. 56, 58)

determining the applicability of plastics films. Three basic techniques used for estimating permeability are the concentration-increase method, the pressure-increase method, and the volume-increase method.

Leak testing of bags. L. A. Warren. Modern Packaging 33, 141 (June 1960). Effective sealing of polyethylene bags requires a rapid method for determining the presence of leaks so that corrective action may be taken. An instrument has been developed that quickly detects leaks or seal failures in unfilled film bags. A hypodermic needle attachment is also incorporated for testing leakage in sealed bags.

Analysis of methyl methacrylate copolymers by gas chromatography. J. Strassberger, G. M. Brauer, M. Tryon, and A. F. Forziati. Anal. Chem. 32, 454-57 (Apr. 1960). Gas chromatographic analysis of the pyrolysis products was used to detect, identify, and quantitatively determine copolymers of methyl methacrylate. Both polymer mixtures and copolymers can be distinguished. The presence of as little as 0.2% copolymer can be detected. Composition of the polymers can be quantitatively determined, with a precision of $\pm 0.5\%$, using standard curves of the ratio of peak areas of known compositions.

Publishers' addresses

Analytical Chemistry: American Chemical Society, 1155 Sixteenth St., N. W., Washington 6, D. C.
A.S.T.M. Bulletin: American Society for Testing Materials, 1916 Race St., Philadelphia, Pa.
Canadian Plastics: Monetary Times Printing Co. Ltd., 341 Church St., Toronto 2, Ontario, Canada.
Chemical Engineering: McGraw-Hill Digest Publishing Co. Inc., 330 W. 42nd St., New York 36, N. Y.
Industrial and Engineering Chemistry: American Chemical Society, 1155 Sixteenth St., N. W., Washington 6, D. C.
Insulation: Lake Publishing Co., 718 Western Ave., Lake Forest, Ill.
Journal of Polymer Science: Interscience Publishers Inc., 250 Fifth Ave., New York 1, N. Y.
Kunststoffe: Karl Hanser Verlag, Leonard-Eck-Strasse 7, Munich 27, Germany.
Materials in Design Engineering: Reinhold Publishing Corp., 430 Park Ave., New York 22, N. Y.
Modern Packaging: Modern Packaging Corp., 575 Madison Ave., New York 22, N. Y.
Plastics Institute Transactions & Journal: The Plastics Institute, 6 Mandeville Pl., London W1, England.
Plastics (London): Temple Press Ltd., Bowling Greene Lane, London EC1, England.
Polymer: Butterworths Scientific Publications, 4-5 Bell Yard, London WC2, England.
Product Engineering: McGraw-Hill Publishing Co., 330 W. 42nd St., New York 36, N. Y.
S.P.E. Journal: Society of Plastics Engineers Inc., 65 Prospect St., Stamford, Conn.
Vysokomolekuliarnye Soedineniia: Academy of Science of U.S.S.R., Moscow, Russia.—End

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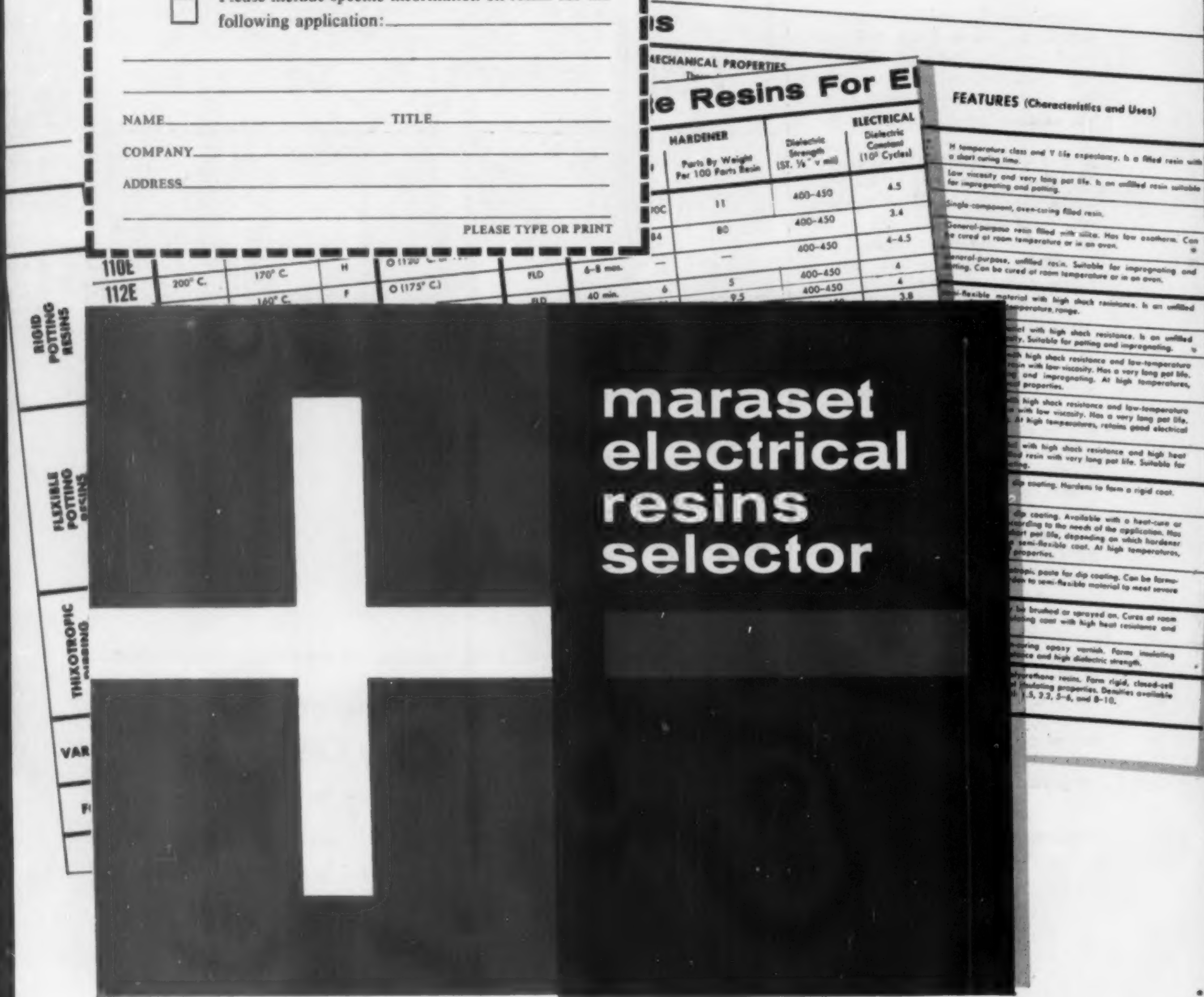

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Easy-to-read tables offer rapid reference for the complete and versatile Maraset "E" series of electrical and electronic resins.

Flexible or rigid "E" resins withstand thermal and mechanical shock, even at high heat, are self flame-extinguishing, meet military specifications.

Filled and unfilled "E" resins for impregnating, potting, dipping, and coating include epoxy varnish, non-sag epoxy pastes, and Marafoam polyurethane foam.

And now — new Maraset epoxy "E" powders:

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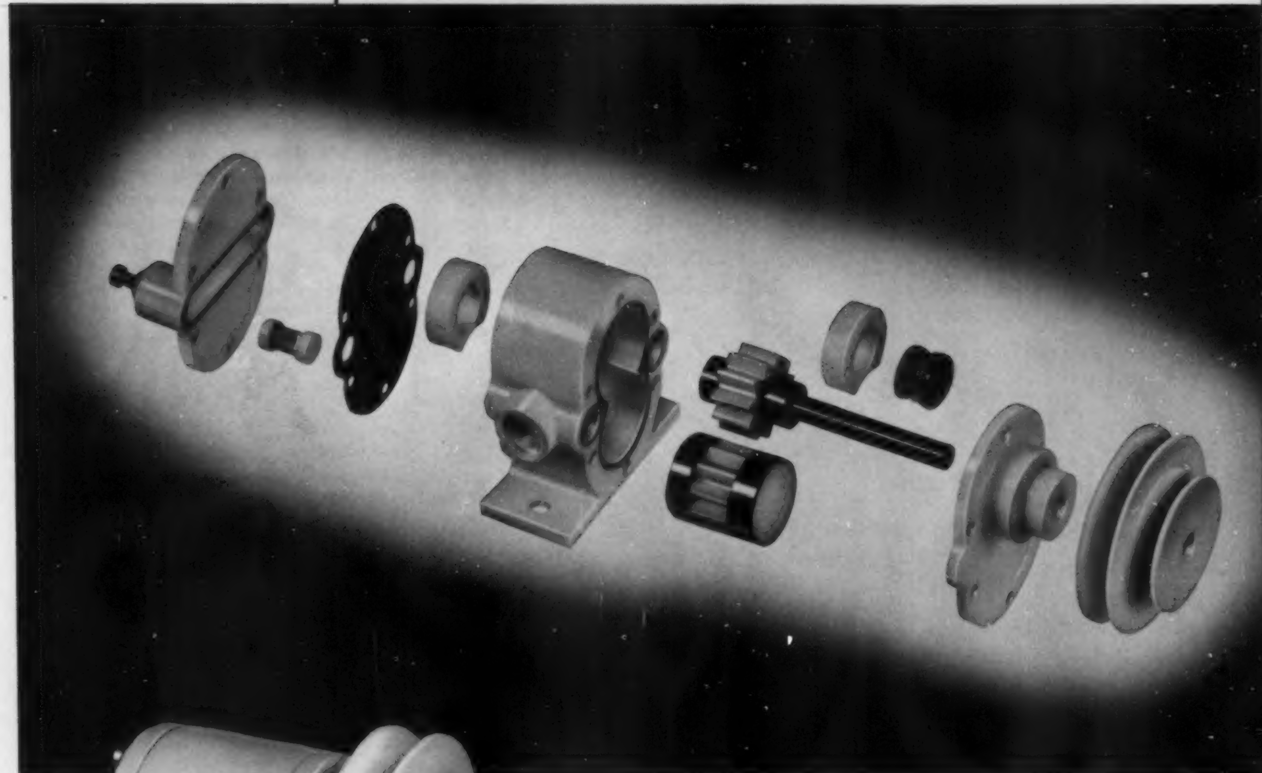

Pump parts of DELRIN® cut costs...reduce horsepower requirements

Here is a new gear pump that attains the maximum advantages of its patented design features by using Du Pont DELRIN acetal resin for all the major parts (housing, gears, bearings, cover plates, bypass valve and drive sheave). Compared with rotary pumps now made in brass and other metals, the new pump of DELRIN has better efficiency, less heat buildup, improved bearing characteristics with no lubrication, quieter operation and longer life. The manufacturer reports that the low friction of DELRIN reduces horsepower requirements as much as 50% over comparable models in brass.

In addition, economical injection molding of these parts to close tolerances—plus the elimination of expensive finishing operations—provides the greatest possible savings in pump cost. The pump parts are molded by Artag Plastics Corporation and Chicago Molded Products for Planet Products of Chicago, Illinois.

As in most applications, it is a *combination* of property advantages that makes DELRIN outstanding in performance. The different parts of the pump depend, in varying degrees, on such properties of DELRIN as: high strength, stiffness, creep resistance, corrosion resistance, non-lubricated bearing characteristics, low friction, dimensional stability, abrasion resistance and excellent fatigue life while subjected to a range of temperatures and environments.

On the following page, you'll find more examples of how these properties are being used to improve the performance and lower the production costs of a variety of pumps. The details may well stimulate your thinking about the advantages of DELRIN for *your* products.

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BETTER THINGS FOR BETTER LIVING ...THROUGH CHEMISTRY

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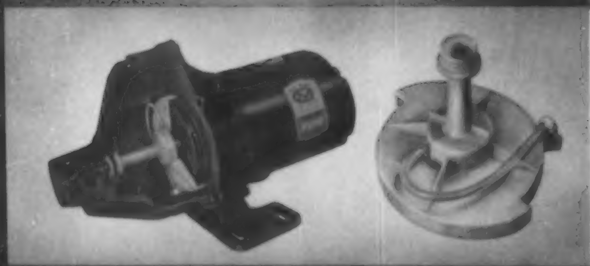
How parts of DELRIN® improve pump performance

WALKER lubricator uses DELRIN for the pumping unit of a new improved central lubricator for vehicles. Here the high temperature strength of DELRIN is a prime requirement—the pump body must withstand under-the-hood temperatures up to 250°F. Pump body, cap, check valve and tube connector are all economically injection-molded of DELRIN. They meet the exacting mechanical requirements for the pump in addition to providing major savings in manufacturing costs. (Molded by G. Felsenthal and Sons, Chicago, Illinois, for Walker Manufacturing Co., Racine, Wisconsin.)



CLAYTON MARK jet pump has an improved volute housing and venturi assembly of DELRIN, replacing the former combination of cast iron and brass, and offers significant advantages in both cost and pumping efficiency. Creep resistance, abrasion resistance and dimensional stability, even under elevated temperatures, are necessary here. The two parts of DELRIN are easily and economically joined by spin welding. (Molded by Chicago Molded Products, Chicago, Illinois, for Clayton Mark Company, Evanston, Illinois.)

RED JACKET "Trailblazer" jet pump uses new injection-molded impellers of DELRIN, because these parts give superior performance over comparable models in brass through increased efficiency, greater abrasion resistance, reduced mineral buildup and longer life. In addition, the use of DELRIN resulted in a 35% saving in impeller costs. (Molded by Chicago Molded Products, Chicago, Illinois, for Red Jacket Manufacturing Company, Davenport, Iowa.)

RED JACKET "Custom Submerga", a new submersible pump, uses DELRIN to achieve new high standards of performance and dependability. In each of the stages, DELRIN replaces brass for the impeller, bowl and diffuser. The fatigue endurance, strength and resistance to creep and corrosion of DELRIN are particularly valuable. According to the manufacturer, precision-molded parts of DELRIN provide an 85-90% cost saving over comparable parts in brass.

These are only a few examples, selected from one particular field, of the many ways in which DELRIN is improving designs and effecting economies in hundreds of applications across a broad range of industries. Why not translate the cost and performance advantages of DELRIN acetal resin in terms of your product? Mail the coupon below for further information.

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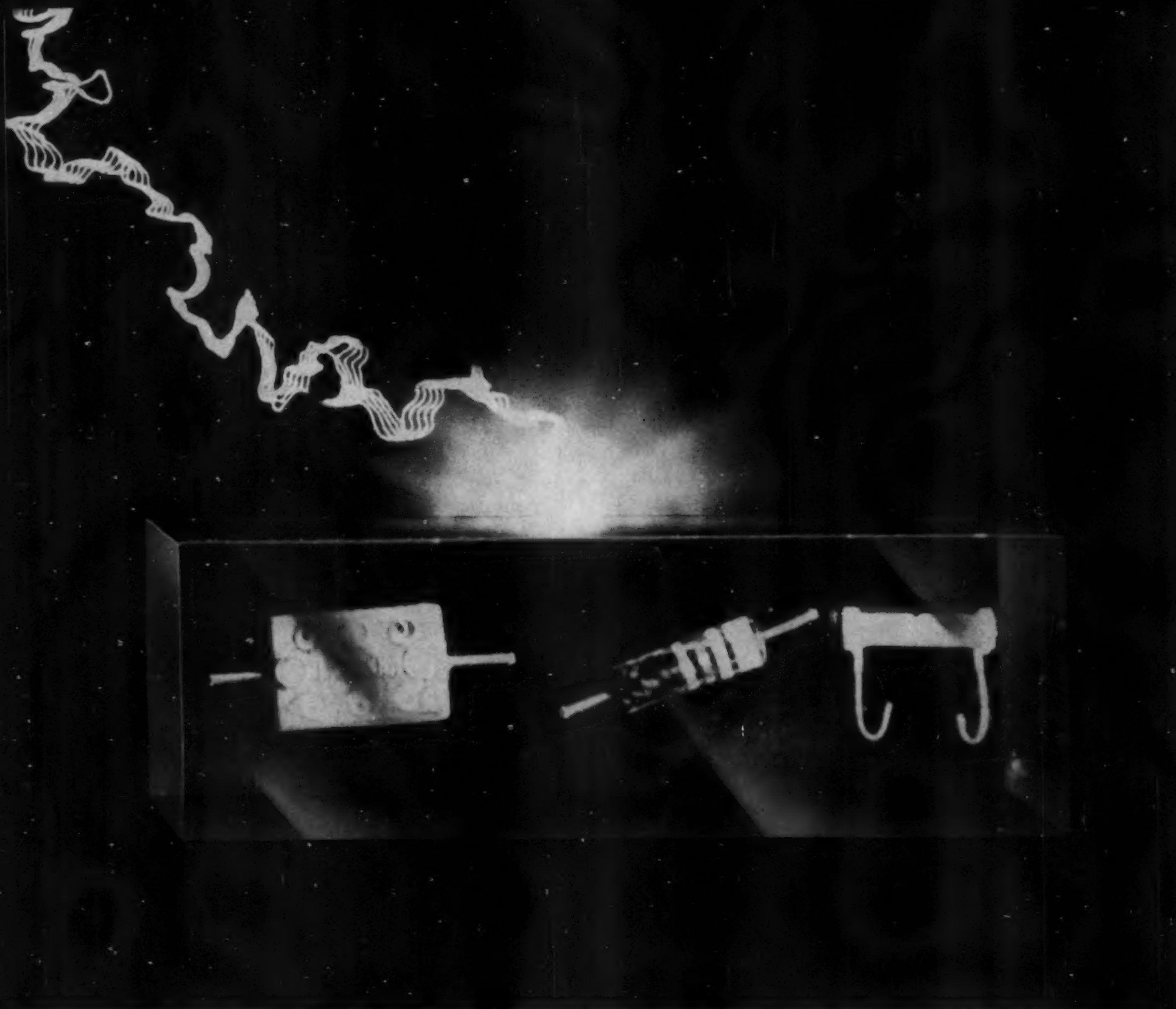

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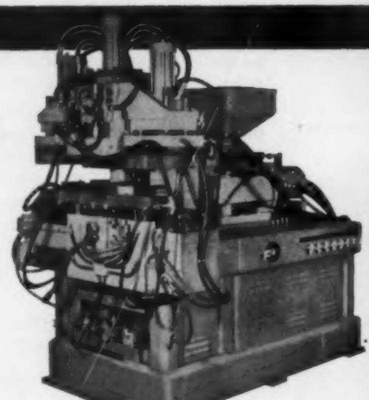


BLOWMOLDER

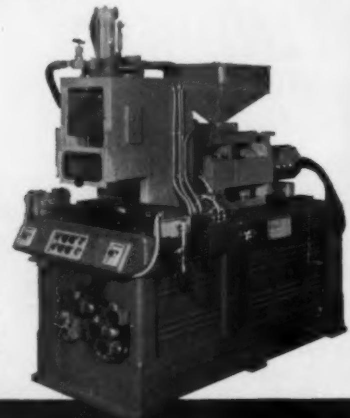
Model 1246

The Model 1246 is a completely automatic **injection type** blowmolder. One to ten bottles can be blown at one time, depending on size. Shot capacity is 4 to 6 oz., and plasticizing capacity is 125 lbs./Hr.

MODEL 74 & 75

The Model 74 is a 1, 2 and 3 oz., fully automatic machine. Plasticizing capacity is 60 to 80 lbs./Hr.

Model 75 is 4 to 6 oz., fully automatic. Plasticizing, 80 to 100 lbs./Hr. (Machine illustrated is Model 74.)



MODEL 11 & 12

The Model 11 is a 3 oz. Duplimatic, designed for insert molding. Plasticizing capacity is 60 lbs./Hr.

The Model 12 has 4 to 6 oz. shot capacity, excellent for heavy duty insert molding. Plasticizing capacity, 80 to 100 lbs./Hr. (Machine illustrated is Model 12.)

The Moslo line of Plastic Injection Molding Machines offer economical, high volume production. Their versatility makes it possible to produce a great variety of industrial and commercial parts. Before **you** buy . . . investigate the Moslo line . . . Write for complete specifications.

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Letters

(From page 46)

ber of drug products or ingredients found in drug products. Paraldehyde injection, benzyl alcohol, diethyl carbonate, benzaldehyde and benzyl benzoate dissolved polystyrene but did not alter the other two types of plastics. Dimercaprol injection, depending upon length of contact, etched the internal surface of polystyrene but did not show any effect on polyethylene or nylon. Dimethylacetamide softened nylon.

Nylon syringes had the ability to bind or sorb significant quantities of a group of drugs possessing acidic hydrogens. One-week contact produced the following results:

Agents which were bound by nylon syringes—expressed as % after one week of contact

4-Chloro-3-methylphenol	85.5
Propylparaben	85.1
Salicylic acid	80.1
Parahydroxybenzoic acid	78.7
Methylparaben	75.5
Benzoic acid	67.1
Phenol	60.5
p-Aminobenzoic acid	51.0
Sorbic acid	47.0
m-Hydroxybenzoic acid	39.5

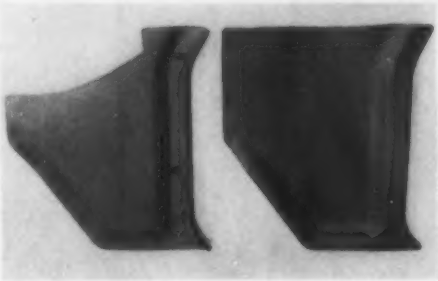
Binding in some instances was noted after only a few hours contact.

I believe that what has just been reviewed should justify some concern by segments of the plastics industry. Unfortunately, my experience with various plastics groups has led me to believe that the plastics industry has little enthusiasm for this subject. In answer to questions concerning drug-plastic interaction, several have admitted that they have not done much work in this area and feel that studies should be conducted by some other group. We are attempting to do this at the university level but lack of funds prevents adequate research.

It is my hope that this letter may stimulate a discussion on the subject of drug-plastics interaction and possible steps which might be taken to formulate certain standards for plastics materials to be used in pharmacy and medicine. The task is not simple but will require serious thought and action if the public is to be completely protected. I would like to see these steps initiated by the plastics industry — perhaps through its Society of the Plastics Industry rather than by a governmental agency.

John Autian, Ph.D.,
Assoc. Prof.
College of Pharmacy
The University of Texas
Austin, Texas

Photo, American Motors



Photo, Ford Motor Co.

HIGH-DENSITY PE moves in fast in 1961 autos. Glove compartment for Rambler weighs 1½ lb., is contoured at rear to make room for defroster ducts. Ford's PE kick panel (right) has molded-in bead on rear edge that eliminates strip of windlace previously required for fiberboard panels.

1961 autos

(From pp. 85-90)

double-walled, extremely strong ducting system—low in cost and easy to install. Because of the construction of the units, thermal insulation is high and there is no need for extra insulating material as would generally be necessary with metal. Fabricating metal ducts in this shape with slip-joint sections, in fact, would have been virtually prohibitive in cost.

• "The first all-plastic automobile hardware" is the claim for the molded Delrin acetal door handles and window regulators for Ford's 1961 line of Econoline trucks. It's an important breakthrough for plastics—one that the hardware industry is watching closely. And Du Pont is counting on the rigidity, toughness, insulating qualities, and dielectric characteristics of molded acetal to keep plastics in there. Weight saving is a little over 67 percent.

For Ford, this is the second new application of acetal. The other is a one-piece housing for a windshield-washer pump for the 1961 Thunderbird. Molded by Delman Co., the corrosion-resistant plastic part replaces one originally designed in a die-casting alloy. And note again—*it's a moving mechanical part!* There's no doubt but that the new, tough thermoplastics are coming closer to a real penetration of this area.

• Last year, Ford Motor Co. shook up the automobile industry with its announcement of a switch to molded high-density PE seat side shields—a switch that meant a ⅓ reduction in part and tooling costs over steel side shields and a 2.8-lb. weight savings per car. Of course, the big question still remained: was this a one-time shot or did it indicate a definite trend? The answer: in its 1961 models, Mercury and Thunderbird picked it up and American Motors plans a similar switch. In its 1961 models, the Thunderbird and Continental excepted, Ford plans to use PE for kick panels. In normal use, these panels, at the left and right ends of the dashboard, are kicked by passengers as they enter or leave the car or as they change the position of their feet. Thus a sturdy, abrasion-resistant material was needed—and high-density PE filled the bill.

The material which PE replaces in this application—an asphalt-impregnated paperboard with a colored surface layer—is relatively inexpensive, but by cutting the number of seals, retainers, screws, etc., previously required to install the panels down to *only two mounting screws,* plastics panels are placed in a more competitive position. The rear edge of the plastic panel, for example, is molded with a bead that eliminates any need for a strip of windlacing previously required in the application; and mounting holes and reinforcing ribs are molded directly into the rear side of the panels. From the functional standpoint, the PE panels, with a molded-in grain finish, offer a higher degree of abrasion resistance, they will not soak up moisture and become soggy, and since color is integral, it cannot be rubbed off.

• Injection molded high-density PE glove boxes is an application one manufacturer feels will be widely adopted within the next two years. In the 1961 Rambler American, the PE glove box being used by American Motors contains about 1½ lb. of material; it is larger than the conventional fiberboard box it replaces; it offers a greater degree of toughness and resiliency; and it is used in conjunction with a large compartment door that opens down to form an ample tray. Ease of cleaning is another important plus. The one-piece box is molded with integral stiffening ribs and is contoured at the back to make room for the defroster duct and nozzle.

Ford Motor Co., which also uses a molded PE glove box that fits into the front seat console of the Thunderbird, has several other high-density PE "firsts" to its credit. These include: a thermoformed spare tire cover for the Falcon and Comet station wagons; protective pivot covers which snap in place over the exposed front seat hinges of the Thunderbird; and molded spring inserts which are used between the spring leaves on the rear suspension of the car. This latter application replaces impregnated cloth strips and by eliminating metal-to-metal contact is designed to keep the spring leaves from scrubbing together and squeaking. Molded-in bumps on the inserts mate with "dimples" in the springs to hold the inserts in place.

• Indicative of plastic's engineer-

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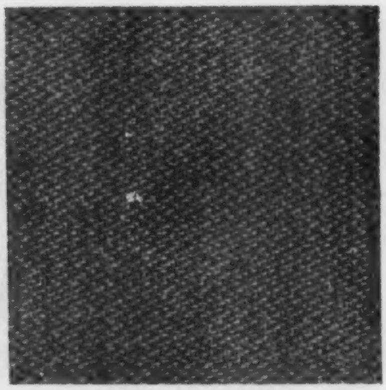
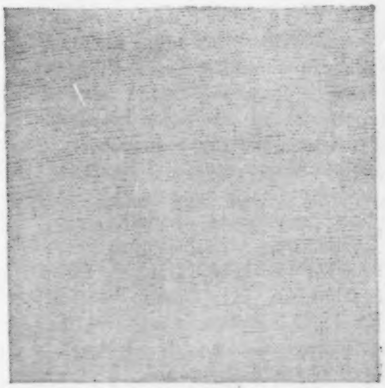
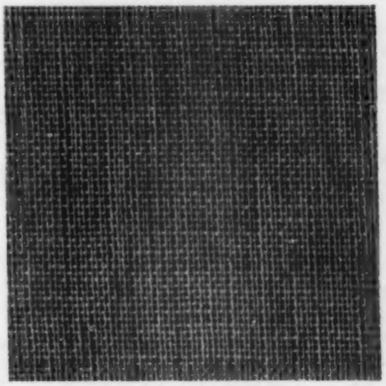


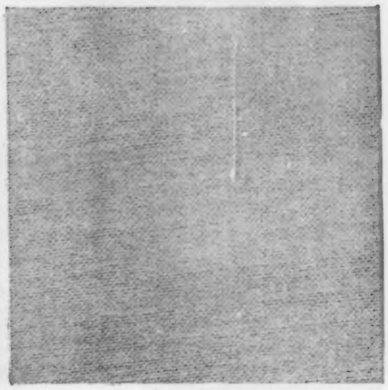
Cotton Broken Twill



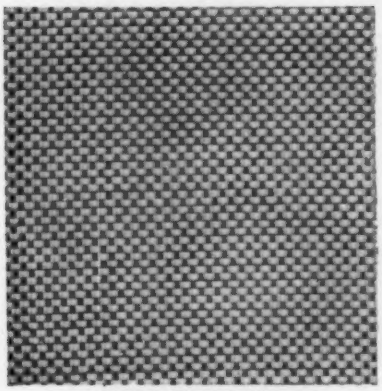
Spun Dynel



Cotton Chafer

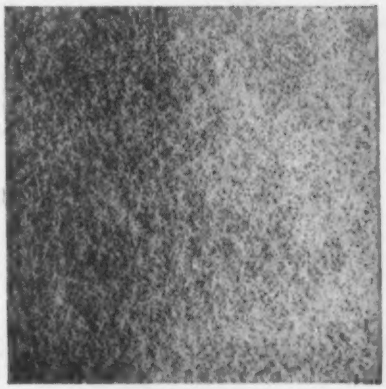


Spun Rayon



Welkote Filament Nylon

Knit Kote



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ing virtuosity in offering designers the widest possible selection of properties is the new instrument panel for the 1961 Cadillac. For the rugged backbone of the part—a frame molded of glass-reinforced styrene (supplied by Fiberfil, Inc.); for the safety cushioning —a foamed-in-place urethane padding; and for the decorative flexible exterior — a sheet of grained vinyl thermoformed around the entire assembly.

• From Ford in 1961 comes the announcement of a lubrication system which requires greasing only every 30,000 miles versus the recommended 1500 miles for most other automobiles. Key to the system is a special grease with a molybdenum-disulphide base and *sealed against contamination with polyurethane caps and liners.*

• Joining urethane and vinyl foam cushioning, padding, etc., applications in the automotive market is polyethylene foam (Ethafoam, by Dow Chemical Co.). As a gasketing material, the polyethylene foam offers a combination of rigidity, low friction, high compressibility, and excellent ozone resistance, that make it a natural replacement for foam rubber and mastic body seals. From a half-dozen applications in the 1959 and 1960 Chrysler line, the material has grown to the point where it will now appear in 30 applications in the 1961 line.

• Next big automotive area for plastics penetration: garnish moldings. American Motors has started the ball rolling by replacing stamped metal trim around the windows in the interior of the 1961 Rambler with injection molded Kralastic ABS strips. Molded in colors that harmonize with the different interior color schemes, the plastic trim has proved far superior to painted metal. And simplified assembly operations swing costs in its favor. From other manufacturers comes word that polypropylene modified acrylic (e.g. Implex), and other plastics are under evaluation. If these applications ever kick loose, it can mean a lot of plastics.

... And rumor has it

While all of the applications described above are actual commercial items that have been re-

leased for publication, there are a number of other fascinating plastics applications still kept under wraps by Detroit. Several of these will probably be appearing in one form or another in 1961 models—but no one is doing much talking about them. Here is a round-up of some you will be hearing about.

• Polypropylene which started to show up in the form of grilles, plugs, defrost nozzles, clips, and knobs in the 1961 autos, will probably have its greatest stimulus later in the year with the introduction of a startling new application—an injection molded polypropylene accelerator pedal. Two major automotive manufacturers are known to be working on this one—and a release should be forthcoming shortly. When it breaks, it should really shake up the industry.

A prototype model developed by Millington Mfg. Corp., Upper Sandusky, Ohio, using polypropylene supplied by Hercules, indicated that the pedal could be molded in one piece complete with an integral built-in hinge that would join pedal and base! Flexes up to 1 million times have been reported. It's the same integral hinge principle (a thin strip of material joins the two halves) that showed up earlier this year in eyeglass cases and portable record carrying cases. Only in this automotive application, it would mean a savings of from 50 to 75% in initial cost (as compared to conventional rubber-covered steel models) plus further economies in cutting down the number of accessory parts and reducing assembly time.

And automotive engineers have been quick to note that it is not too far a jump from the pedals to glove boxes, integral dampers in the air-distribution systems, ash tray bezels and covers, and snap-on dome light lenses—all with that integral hinge feature.

• An extruded high-density PE duct or conduit which encloses a number of electrical wires within the passenger compartment of the car is reportedly under evaluation. A "zipper" feature facilitates access to the wiring. The conduit is installed beneath the carpet of the passenger compartment.

• One manufacturer is reportedly

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• One manufacturer is reportedly

experimenting with a radiator reservoir molded of polyester-glass premix materials as a replacement for the currently-used brass type.

• Nylon-6 polycaprolactam is being evaluated as tubing for gas lines. Already field-tested by Spencer Chemical Co. on its own fleet of automobiles, the lines are easy to install, eliminate the need for flexible connections, do not have to be pre-formed, can be used with standard fittings, and, can take under-car punishment without showing damage.

Most of the applications described above are so new that the pessimists who always hover over the automotive industry are already predicting that they will be back in metal next year. But then again, these are the same pessimists who have been predicting since its introduction in 1954 that Chevrolet's Corvette sports car body was going back to metal. And here comes the 7th model—and it is still polyester-glass.

Anticipating the future for plastics in the automotive industry is a tricky business at best. But one doesn't need a "crystal ball" to see some of the more obvious trends. Just skimming through the list of applications on p. 87, it becomes obvious that injection molded thermoplastics are moving in at an unprecedented pace to compete with die-cast zinc, magnesium, and aluminum for a good share of the automotive markets. Emphasis will be on the newer, tougher thermoplastics—with the ABS copolymers, linear PE, polypropylene, acetal, nylon, and high-impact styrene leading the parade. As soon as a new plastic is announced, the automotive engineers seem to be there waiting with bated breath. Dow's new styrene/methyl methacrylate alloy has already shown up in a number of dial faces; Rohm & Haas's Implex modified acrylic was immediately snapped up for dial faces, lenses, arm rests, instrument clusters, and the like; and even polycarbonate, despite its price, is under consideration; General Electric already reports two automotive applications—brake bushings and brush holders—for its Lexan polycarbonate.

Surprisingly, these new mate-

rials are not hitting the longtime standard applications for acrylic, butyrate, phenolic, etc., in the auto. In every case, the application is either a new one or one that is being serviced by a conventional material.

The introduction of the "compact" car which may account for 40 to 50% of new car production by 1962, is certain to further plastics penetration of the car market. One need only look at the European autos where the "compacts" have held sway for two years longer to get some idea of what to expect. The Fiat 2100, for example, contains over 12 lb. of parts molded of Kralastic ABS copolymer, including a one-piece dashboard molding, window trim, and steering wheel housing. On other models, ABS is even being used for door handles to replace zinc magnesium alloys. The Renault uses an RP premix oil spout; the Citroen has an RP roof, nylon lines for an air-oil suspension system, liners of vinyl foam. Radiator fans molded of nylon or ABS are already commercial; Citroen has nylon dashboards, guards, housings, etc.; Opel uses a polyurethane brake pedal stop; and the list can go on and on.

The conclusion to be drawn is a simple one: while the "car of tomorrow" may not yet be on the drawing board, when it does reach that stage, it's a good bet that plastics material will have a major role to play—as the "automotive industry's most versatile engineering material."

Credits: Special thanks for assistance in the preparation of this article to the following materials suppliers: E. I. du Pont de Nemours & Co. Inc.; U. S. Rubber Co.; Marbon Chemical Div., Borg-Warner Corp.; Hercules Powder Co. Inc.; Spencer Chemical Co.; Phillips Chemical Co.; W. R. Grace & Co.; Rohm & Haas Co.; Dow Chemical Co.; and Owens-Corning Fiberglas Corp. Special thanks are also due to the following auto manufacturers who contributed: Ford Motor Co.; American Motors Sales Corp.; Chrysler Motors Corp.; and General Motors. We also wish to acknowledge the help of The Society of the Plastics Industry Inc. for the material it gathered.—**End**

Shevett, Charles Kuss, Henry Shevett • Pioneer 6-7135
Thomas Ryan • Davis 4-2257
• Larry Franks • Walnut 8-3860 (New England)
Allan Niebuhr, Jack Frost, John Mann • Essex 4-7440
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n R. Davis • (Atlanta) GLendale 7-5901
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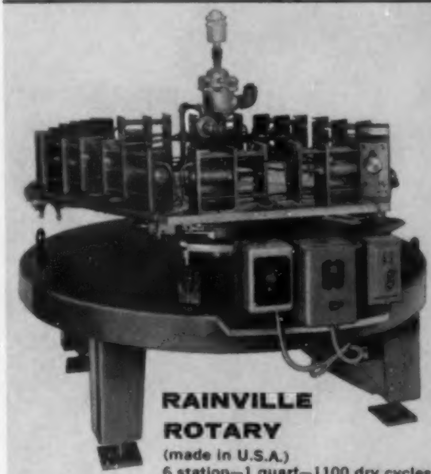

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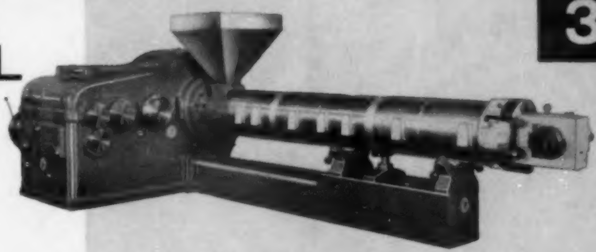

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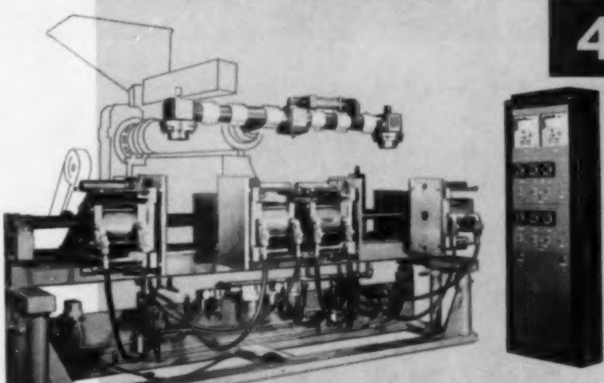

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Maximum Thickness of Part:	11 inches

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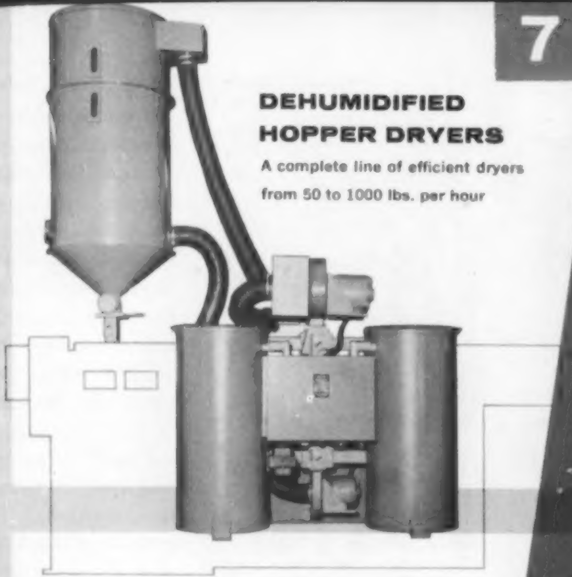

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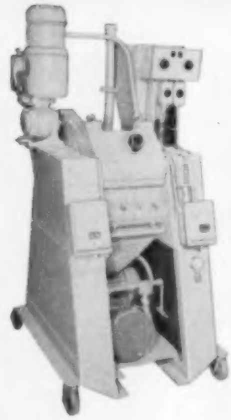

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- Molding Scrap
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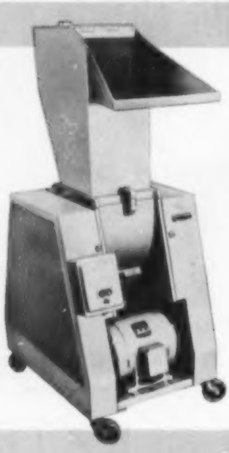

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Model	HP	Throat
HD-1	3	8½ x 10
HD-1F	5	8½ x 10
HD-2	5	10 x 14
HD-2F	7½	10 x 14
HD-3	10	10 x 20
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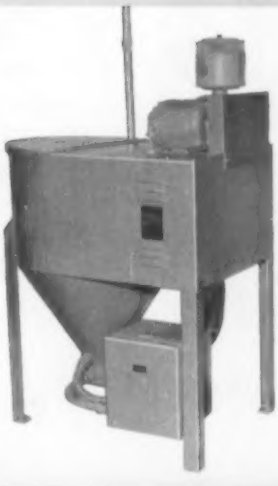

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11

Iron handles

(From pp. 92-94)

most of the pivot bearings, holes, and threads were molded directly into the handle.

Phenolics are number-one handle material

Today, phenolic compounds of the heat-resistant type stand unchallenged as the chosen material for iron handles. From time to time, other types of materials, including some thermoplastics, have been used in a limited way for such components as decorative handle inserts, but modern phenolics offer the best balance of properties required for this application. Most handles are produced in a glossy black color, but if other shades are desired, they may be obtained by coating the phenolic handle with a durable epoxy-type finish.

Although modern electric irons use a permanently mounted cord requiring no removable plug, at one time such heater plugs were an important outlet for phenolic materials. In 1929, for example, there were more than 5 million such molded phenolic plugs in use. These plugs incorporated asbestos type filler for added heat resistance and had to be preformed under heavy pressure.

Meanwhile, the producers of phenolic molding compounds continue to develop improved formulations, some of which may be expected to find application in iron handles. One major producer, Union Carbide Plastics Co., is said to have under field test new compounds that, without postcure, can withstand a temperature of 500° F. for 1000 hr. with a 90% retention of physical properties. This compares with a retention of 25% or less in flexural strength for conventional phenolics after only 150 hr. exposure at that temperature.

Development of such higher temperature compounds may further increase the amount of phenolics used in modern iron designs. Growing sales of steam irons (*Electrical Merchandising Week* predicts 1960 totals at 19.3% above 1959, for example) will further stimulate this important phenolics market.—**End**

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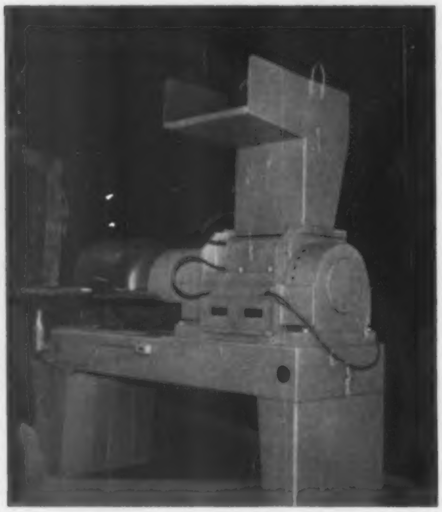

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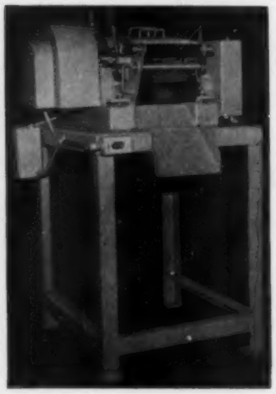
Alsteele Granulator, Model 24 x 36, for grinding very large molded parts without prior cutting. Several models in this series can granulate entire refrigerated door liners. Available in sizes 12 x 24", 12 x 36", 12 x 48", 12 x 60", 24 x 36", or larger



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How to market-test

(From page 95)

any such test instrument be effectively insulated against transmitting an electrical shock to the operator. From the standpoint of physical abuse, it is inevitable that such instruments, being used in a garage or service station, will be subjected to various drops and bumps which would be likely to dent some types of housings or gradually wear off any applied finish. Finally, the plastic case is resistant to the effects of oil, grease, gasoline, etc.

When AC was ready to begin manufacturing the ACilloscope, various approaches were studied which would get the instrument into production while the injection molds were still being built. The solution was found in setting up preliminary production of the housing by vacuum forming it from sheet stock.

Working with Cycolac sheet material, Henson Mfg. Co., Waterloo, Ia., turned out several thousand housings, using wooden forming blocks. The two sections of the case, designed with an offset or overlap type of joint, were assembled by using rigid vinyl tubing spacers between the right and left halves.

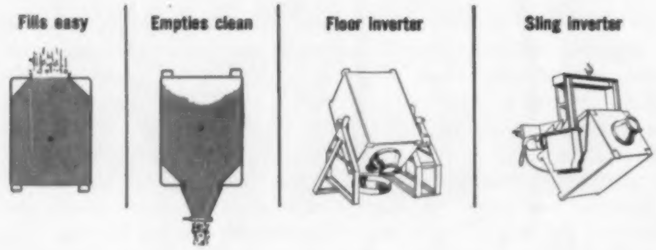
By turning to thermoforming for the opening production of the ACilloscope, AC was able to get thousands of the instruments assembled and into the field, even before the injection tools were completed. Tooling cost for these preliminary parts was quite low. This dual approach also permitted actual field testing, on a significantly large scale. The satisfactory performance of the material in the formed version led to its continued use when the injection molded case went into production some weeks later.

Components for the injection-molded Cycolac case are produced for AC by Northwest Plastics Inc., St. Paul, Minn., which also made the two single-cavity molds used for this job. Molded on a 22-oz. Natco injection machine, the parts are permitted to cool on a flat surface before several openings are drilled with a fixture set up beside the press. This operation is handled by the press operator during the normal molding cycle. No shrink fixtures are required for the case halves.

The matching halves of the ACilloscope housing incorporate strategically spaced internal ribs, supporting cored bosses, through which they are assembled with bolts. A tongue and groove type of joint is used around the perimeter of the housing, providing a sealed assembly of the halves.

In addition to the housing, other plastics applications in the ACilloscope include circuit boards of phenolic-impregnated Triple XP paper, epoxy connectors, a Plexiglas safety shield, and vinyl chloride wire jacketing.

Final manufacturing operations on the ACilloscope are handled by AC Spark Plug at its Milwaukee, Wis., plant. Here the electronic tube, wiring, terminals and other internal components are mounted in one side of the case, lead wires connected, and the other half assembled to it.—**End**



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Premix in foghorn

(From pp. 102-103)

molds the major components in a 75-ton hydraulic press manufactured by Erie Foundry Co., Erie, Pa. Matched dies of chrome-plated cast meehanite for these parts were made by M. A. Cuming & Co., New York, N. Y., and by the Newark Die Co., Newark, N. J.

The divider vanes are molded in a 50-ton compression press made by Hannifin Co., Div. of Parker-Hannifin Corp., Des Plaines, Ill. The mold for the vanes was made of tool steel in Wallace & Tiernan's own shop. Mold temperatures are in a 290 to 300° F. range, and cycles vary from approximately 1½ min. for the vanes to about 3 or 4 min. for the larger parts.

After molding, parts require only a small amount of deflashing and sanding of bonding surfaces before they are ready for assembly. The parts are placed in fixtures and bonded to one another by an epoxy adhesive formulation based on Epon 828, produced by Shell Chemical Co. An O-ring gasket is fitted into a molded groove in the top cone section to seal the operating mechanism against moisture. The cover is not bonded to the top cone, but is clamped on by a single-bolt, stainless steel band.

Although the market for the half-mile foghorn is not known, Wallace & Tiernan estimates that sales of its horn amount to approximately 40% of all horns sold. High on the list of future plans of the company is an extension of the design of the present reinforced plastics foghorn into special-purpose fire and distress horns.

List of suppliers

The following suppliers provided materials for the foghorn: *Resins:* Selectron 5158, Pittsburgh Plate Glass Co., Paint Div., Pittsburgh, Pa., or Laminac PDL 7-919, American Cyanamid Co., Plastics & Resins Div., New York, N. Y.; *Reinforcement, larger parts:* ½-in. coated glass fibers, Modiglass Fibers Inc., sub. of Reichhold Chemicals Inc., Bremen, Ohio, or HSI, ¼-in. high strand integrity glass fibers, Owens-Corning Fiberglas Corp., New York, N. Y.; *Reinforcement, smaller parts:* ¼-in. chopped strands, Pittsburgh Plate Glass Co.; *Fillers:* Camel-Tex, calcium carbonate, Harry T. Campbell Sons' Corp., Baltimore, Md.; ASP-400, aluminum silicate, Minerals & Chemicals Corp. of America, Menlo Park, N. J.; and 7TF1 asbestos fibers, Johns-Manville, Asbestos Fiber Div., Quebec, Canada; *Catalysts:* Luperco ABB, benzoyl peroxide, 50% solution, Wallace & Tiernan Inc., Belleville, N. J.; T-butyl perbenzoate, Wallace & Tiernan; *Inhibitor:* P-Benzoquinone sol. (1 to 100 in styrene), Eastman Chemical Products Inc., Chemical Div., Kingsport, Tenn.; *Mold release agent:* zinc stearate, American Cyanamid Co., Organic Chemical Div., Bound Brook, N. J.; and *Pigment:* fire-red powder, Plastics Color Co. Inc., Chatham, N. J.—**End.**

Melamine preferred

(From pp. 106-107)

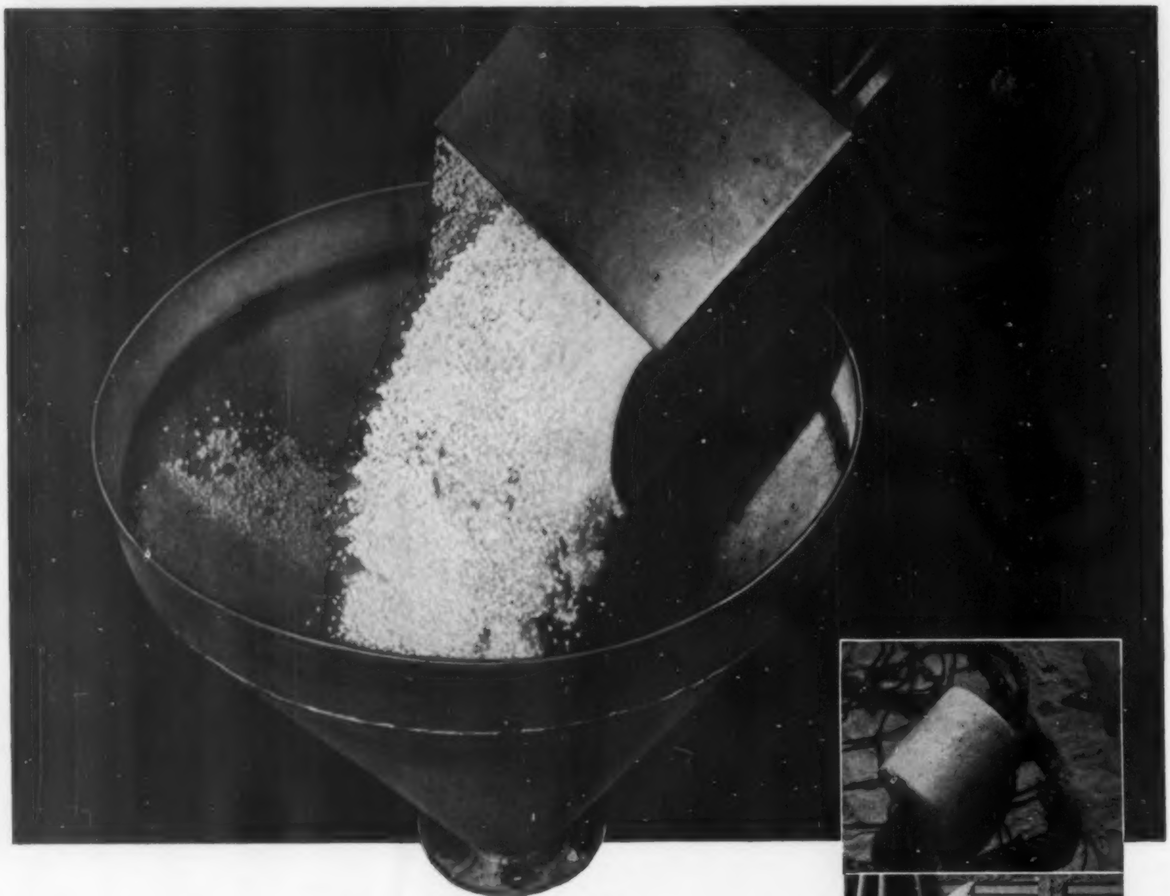
resistance and rigidity to keep the housing new-looking for years.

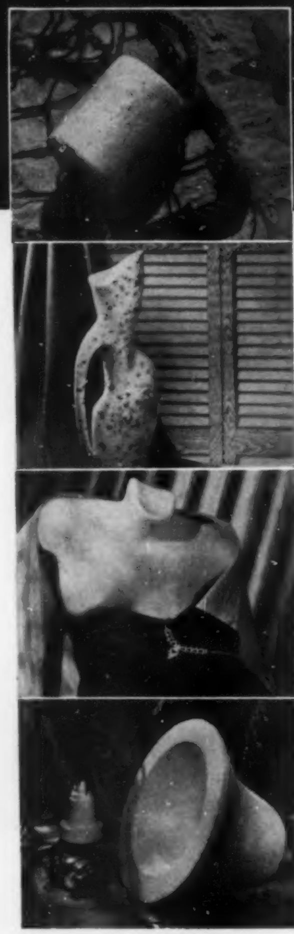
The platen and its interlocking platen hinge plate are joined at the outer edge by metal pins, permitting the platen to be swung upward to close the front of the laminator when it is not in use. This assembly mounts to the internal framework with two metal screws. When it is necessary to replenish the supply of polyester film, these screws are removed, permitting not only the platen assembly but also the entire bezel to be lifted off for access to the operating mechanism.

The five nylon gears used in the Apeco laminator include two spur gears which synchronize the upper and lower rollers and three Gilmer type timing pulleys which synchronize the main drive with that of the combining rollers and also the speed of the expeller roller. These parts are injection molded in a family mold by Midwest Molding & Mfg. Co., Gurnee, Ill. According to Burton D. Eisner, chief engineer, these gears are not only economical, costing approximately one-fourth as much as hobbed metal gears, but also require no lubrication, which might present a staining problem when documents are run through the machine.

These parts, molded in natural nylon, are dyed black before being assembled in the laminator, both for appearance and to insure that there will be no further moisture take-up after the parts are in the field.

The extent of plastics usage in the Ply-On laminator lends impetus to a growing trend in the field of office and business machines, namely the design of such equipment in terms of materials that will give improved performance at reduced manufacturing costs, regardless of any design tradition. Whether for gigantic installations (See "Post office modernizes—with plastics," MPl, June 1960, p. 92) or for relatively small units as described above, plastics—of all types—are proving their superiority in both performance and cost.—End





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Pelvic model

(From pp. 108-109)

was the choice for these parts; dry coloring to avoid a perfectly uniform color which would detract from life-like appearance, and high-impact polystyrene, because of its inherent semi-glossy surface, for the same reason.

Base foam laminated

To avoid the expense of another mold, the "C" frame base insert was stamped from high-impact polystyrene sheet to which a polyurethane foam was laminated. (Gilman Bros., Gilman, Conn.) Use of the foam eliminated the need for applying a felt base after assembly.

In addition to the molding operations involved, the transparent side plaques are masked (masks by William Fiork, Brooklyn, N. Y.) and spray painted in two colors. A flesh color is used to represent surrounding tissue with the symphysis and coccyx sprayed a cream color to represent and highlight these two bone structures. The organs are then assembled and cemented into their respective left and right side plaques, and the die cut, foam laminated base is cemented into the bottom of the "C" frame.

Molding cycle is long

Significant in the successful molding of these pieces to the required tolerances are the long cycles, averaging about 1 min., used in molding so that the pieces will be amply cooled prior to ejection. This accounts in large part for the ability to avoid distortion after removal from the mold. Although the longer cycle does reduce the hourly production rate, it is more economical in this case because it reduced rejects.

When completed, the model met all the requirements of practicality, durability, and quality that are Ortho's hallmarks for its pharmaceutical products.

As a case study in precision engineering and molding of plastics, it is certainly indicative of what can be accomplished with any difficult job when it is carefully planned, thoroughly thought through, and then executed with the same care.—End

Why biaxially

(From pp. 111-114)

ture in the unoriented pipe is approximately that which will only result in causing a 2% elongation of the oriented pipe. It will be seen that for long-term (50-year) service at this temperature the minimum breaking strength predicted for this particular pipe is twice that for unoriented high-density pipe.

Accelerated tests on the oriented pipe at 80° C. (176° F.) show that the knee due to crack failure is extended at least a decade farther out along the time axis than with unoriented pipe. Tests in Hercules laboratories on a representative set of oriented pipes (1.97 and 2.66 in. O.D.) show that, at 80° C. (176° F.), a hoop stress of 1125 p.s.i., which would cause unoriented pipe to fail in ½ hr., had not broken this oriented pipe after 3000 hr. exposure.

This means that by biaxial orientation, using a stretch ratio of 1.7:1 in both directions, only half the pipe wall thickness is needed to maintain the same strength. Since material cost is about 60 to 70% of the total manufacturing cost of polyolefin pipe, it appears that a real saving can be made in producing pipe of strength meeting CS 197-60. Alternately, pipe twice as strong as that now made could be furnished. Table I, p. 113, shows some representative pipe weights and working pressures calculated for sizes listed in the above standard, also for pressure rated pipe, made by the orientation technique. A design hoop stress of 1200 p.s.i. at 73° F. was used in these calculations to determine the allowable reduced wall thickness for satisfactory operation.

The values of Table I are based on the fact that both I.D. and O.D. are used as the basis of polyethylene pipe sizes. In U. S. Department of Commerce Commercial Standard CS 197-60, dimensions and tolerances for Series 2 and Series 3 are based upon I.D. The wall thickness, and hence O.D., vary with the type of resin used. If biaxially-strengthened high-density polyethylene pipe is made to the dimensions shown in CS 197-60 for Type III resin, the working pressures for these two Series become 150 and 200 p.s.i. instead of the present 75 and 100 p.s.i. for present, unoriented resin. If it is desired to make a 100 p.s.i. rated pipe by biaxial orientation, the desired strength may be obtained as shown in Section A of Table I, with walls only 43% as thick as those in the standard. These thicknesses are the minimum one should consider for a practical pipe in the smaller sizes. Conversely, due to the weight-saving in biaxially oriented pipe, one could consider the hypothetical 4-in. or 6-in. pipe in 100 p.s.i. rating at weights per foot no greater than Schedule 40 sizes which have lower pressure ratings. These are considerably lighter than the Schedule 80 sizes for unoriented pipe which approach this pressure rating and could be handled more easily.

To further illustrate the strength of this two-way stretched pipe, Section B of Table I compares unoriented Schedule 40 and 80 pipe with those for pipe biaxially oriented to these same dimensions. This section also indicates what working pressures are practical using threaded oriented pipe in these sizes. Other proprietary fittings such as the Victaulic line can also be considered for the sizes shown as indicated for threading. A better performance of biaxially oriented Schedule 80 threaded pipe is indicated over the same sizes as presently made from Type III resin; conventional high-density PE.

Commercial applications

Oriented pipe is expected to be useful at temperatures up to 60° C. (140° F.). Its suitability for outdoor skating rink freezer coils should be outstanding since the thinner walls possible can transfer heat better than thicker walled pipes. Because of its high strength, biaxially oriented 3- to 6-in. pipe, joined by threads or snap-fit couplings, can also be used for farm irrigation, temporary salt water lines in oil fields, as well as for replacement of cast iron and transite water lines in other field applications.

In addition, oriented pipe has a smooth, satiny surface and be-

cause of a high elastic modulus is less readily marred or scratched than unoriented pipe.

Possibilities for hot water piping

The use of oriented high-density polyethylene pipe for domestic hot water service does not seem advisable, since this service requires that a pipe withstand 90° C. for 30 years without failure at hoop stresses above 600 p.s.i. The 80° C. curve, (Fig. 6), projects well below this goal, making this application inadvisable. Also, long-term exposure to temperatures within 30° C. of the orientation temperature tends to destroy the orientation and cause shrinkage as the orienting stresses in the pipe relax and decay.

For hot water service, biaxially oriented pipe made of polypropylene is an intriguing possibility. When Pro-fax[3] polypropylene pipe of 1.26-in. O.D. and 0.051-in. wall was oriented, the hoop stress projected for failure was one-third greater than for similar unoriented pipe (2). Another advantage of the biaxial orientation, is the increase in the polypropylene pipe's resistance to shock at low temperatures. Data on the unoriented and oriented polypropylene pipe described above show that when a 2.2-lb. weight is dropped on the pipe, from heights of 5 and 10 ft., the temperature at which fracture takes place is lowered considerably by orientation as shown in the following data:

Distance	5 ft.	10 ft.
Unoriented pipe	+ 8° C.	+18° C.
Oriented pipe	−20° C.	− 5° C.

Similar observations were made on oriented high-density polyethylene pipe, at levels 40 to 50° C. below those shown.

To join sections of the oriented pipe, a new type of friction fitting, illustrated in Fig. 7, p. 114, has been developed in Europe (5). Made of aluminum or brass, this fitting gives joints of integrity approaching that of the plastic pipe itself.

This development of a process and equipment capable of biaxially orienting polyolefin pipe at speeds approaching those now in use offers a new tool to the plastics industry in its drive to reduce costs and widen the markets for its products.

[3]Trademark of Hercules Powder Co.

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1. G. Diedrich, Farbwerke Hoechst A. G., private communication, Sept. 27, 1957.

2. G. Diedrich, Farbwerke Hoechst A. G., personal communication, Oct. 17, 1957.

3. R. D. Hanna and J. Y. Lomax, Modern Plastics *36*, No. 6, (1959).

4. K. Richard and E. Gaube, Kunststoffe *46*, 262 (1956).

5. K. Richard, G. Diedrich, and E. Gaube, Kunststoffe *49*, No. 11, 616 (1959). For additional reference, also refer to an article by these same authors *ibid.*, *50*, No. 7, 371 (1960).—**End**


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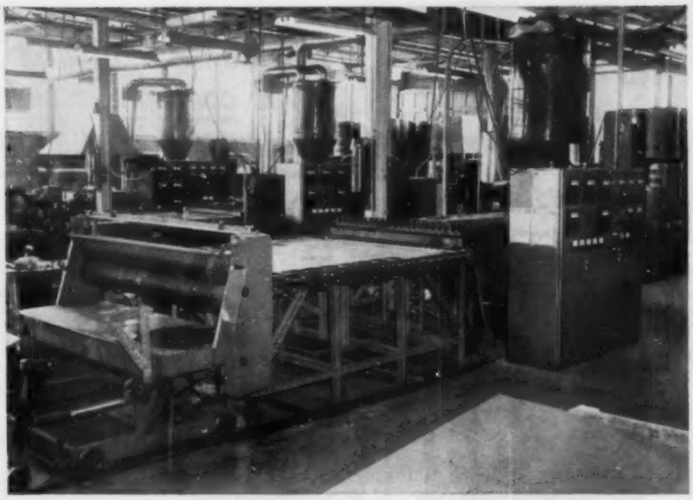
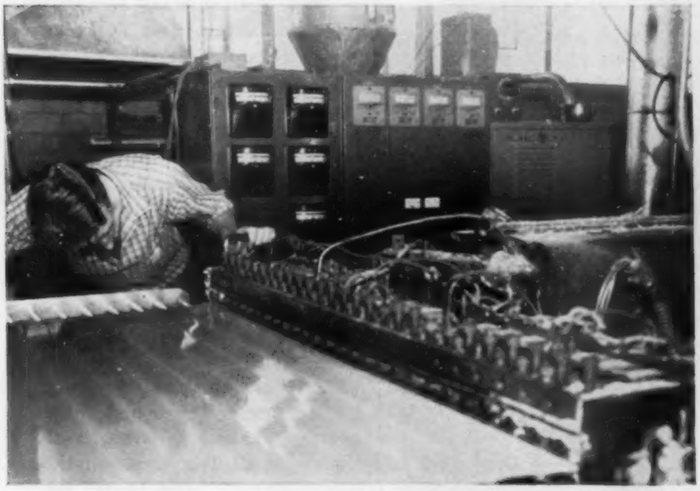


Granular plastic is heated to a flowing consistency as it passes through the barrels of Cadillac's extruders. Temperature across the dies must also be controlled to maintain uniform caliper and output.



Temperature is controlled in the hopper section, the 1, 2 and 3 zones, the extruder gate, and at five points across the width of the die. Here, the extruder is adjusted to control thickness of a plastic sheet.

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How molding conditions

(From pp. 116-122)

of relative degrees of orientation in polypropylene, it is concluded that the toughness differences produced are not primarily due to orientation. Another fact refuting orientation as a big variable is that different mold temperatures had a very slight, if not negligible, effect upon the toughness of the articles. This was true for both test bar values and the ball-drop results.

Other properties

Measurements of flexural stiffness, hardness and shrinkage as a function of the heater settings were also made. In general, no significant change with stock temperature was observed in any of these properties. This is as expected since the properties measured are primarily a function of the degree of crystallinity which in turn is a function of the isotacticity. Thus, temperature of the melt during injection has very little effect upon the final crystallinity of the molded article, relative to the effects produced in going from one level of isotacticity to another, or the effects that were produced by differences in mold temperature.

Even in changing the mold temperature or the degree of isotacticity, hardness was hardly affected at all. The range of hardness variability with heater settings, degree of isotacticity, or mold temperature can be described by a Shore D hardness of about 69 (plus or minus 3) over the complete range of variables that were studied.

Shrinkage was about 0.017 $\pm$ 0.003 in./in. This change of approximately $\pm$ 0.3% includes variations in the heater settings ranging from 450 to 650°F., or mold temperature variations from 130 to 190°F., or variations in isotacticity from about 85 to 95%, or changes in molecular weight distribution. This same shrinkage range includes the total effect realized by going from one extreme to the other in all these variables.

The flexural stiffness was practically unchanged with respect to variations of mold or cylinder temperature. However, as ex-

pected, it did change considerably with degree of isotacticity as previously stated.

Conclusion

In summary, changes in cylinder temperature chiefly affect the elongation and ball-drop impact resistance of molded polypropylene. In general, increase in cylinder temperatures up to a stock temperature of about 575°F. does not produce adverse effects on appearance or physical properties. Please note that stock temperature and the length of time the material is held at that temperature are the governing factors. The stock temperature will not be the same as set cylinder temperature unless the material remains in the cylinder long enough to reach equilibrium. However, if one carefully evaluates inventory time-stock temperature relationships it is possible at least to qualitatively translate the foregoing results in terms of machines of various size and in terms of the variations in plasticizing capacity to shot weight ratio that are encountered.

In general, the molder should avoid subjecting polypropylene to stock temperatures in excess of about 600°F. for appreciable lengths of time. If this is used as a guide in sizing the machine to the job, both good cycle time and part quality will be obtained.

As with any thermoplastic, if polypropylene is long subjected to high temperatures it develops an odor as well as some discoloration. Where an exact color match is required, the discoloration of the base material itself may introduce difficult problems. This then is one more reason for attempting to control the stock temperature in such a manner that it does not appreciably surpass approximately 550°F. for any extended period of time, which, fortunately, is a temperature near that at which the best drop-ball impact resistance is obtained.

With proper mold design, polypropylene's stability with respect to properties, appearance, and performance in the face of relatively wide changes in molding conditions means that polypropylene will become one of the molder's favorite materials.—**End**

Optical gaging

(From pp. 124-126)

tion of a complex part often requires considerable handling. It is not at all unusual to find optical gaging many times faster in this respect. In addition, mechanical gaging of a complex part usually requires several different gages adapted to each measurement to be made.

The wear of mechanical gages was a continual problem. Frequent gage check and repair were necessary in order to maintain required tolerance. It is often stated: "There is no wear on a light beam." This is more than just a slogan; it is a saving in dollars. Less maintenance is required in optical gaging equipment because wear is generally a small, if not a non-existent, factor.

For high volume and long production runs, the heavy load on mechanical gages requires the user to maintain several sets in order to keep up with the inspection schedule. As mentioned before, it is obvious that duplicate sets of gages will also involve a significant increase in the capital invested in the tooling up for a production job. However, with optical gaging duplicate gage sets are seldom required. Sometimes duplicate gage charts are required for repetitive inspection operations done on the same part at different places or different plants; for example, between the customer and ourselves. In such cases it is a simple matter to reproduce identical optical gage charts from a standard master for a fraction of the original cost. In addition to the cost savings, a considerable amount of time is also saved in making duplicate gage charts, since it takes no more time than it does to make a photographic print. Final inspection can be done with a chart identical to that used by our customers' receiving inspection. This obviously reduces losses in time due to uncertainties arising from the use of different sets of dissimilar inspection gages at different points.

When using mechanical inspection, an engineering or design change will sometimes require extensive gage modification. Occasionally, the entire original cost

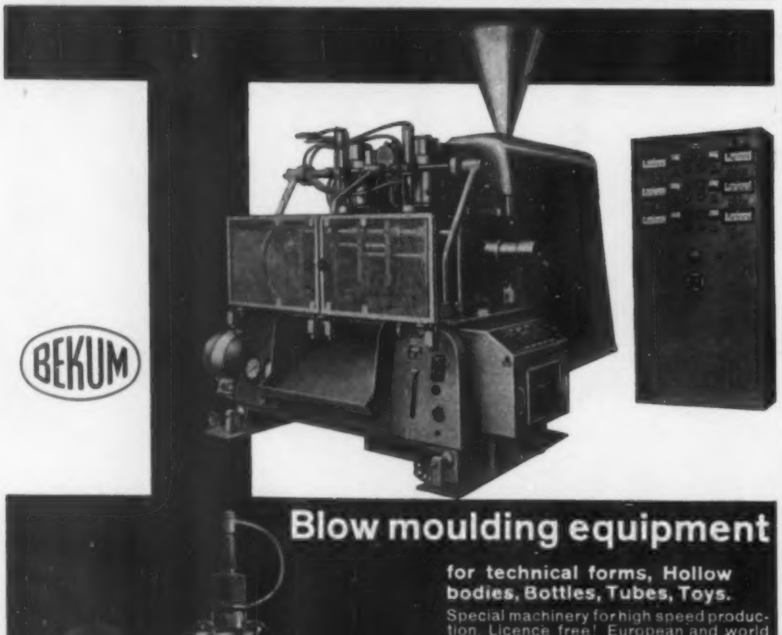
of gages must be reincurred. On the other hand, when using optical gaging a design change may result in no fixture alteration at all and only a simple change in the gage chart. When the gage chart is changed, the old dimension is erased and a correct dimension can be inscribed quickly. New chart gages are reproduced in a relatively short time, with additional economies resulting from reductions in the usual waiting time after specification changes.

Operator's skill has an effect on inspection costs. Fixed gaging frequently requires gage inspectors of considerable skill and experience with a well-educated sense of "feel." Optical gaging, on the other hand, offers sizable benefits in the use of unskilled operators. They can learn to gage accurately on a particular screen in a short time.

With many gaging methods it is often necessary to report many successive measurements to obtain a complete picture of the inter-relationship of dimensions. This is seldom necessary with optical gaging, with the work piece outline and interrelated dimensions seen simultaneously on the screen.

There is considerable economic advantage from the bonus information resulting from the optical inspection. Mechanical inspection gave us little or no information about the part which was not specifically sought. With optical inspection on the other hand, the projected outline permits inspection of all contours, and there are many characteristic outlines which can be compared to the drawing dimension. Such things as fillets, under cuts, chamfers, radii, etc. are readily seen. The intangible values of these "plus factors" are sometimes hard to evaluate in terms of dollars, but they are definitely potential values in the business of inspection.

We regard protection of quality as a matter of economy when we weigh the cost of inspection against the consequences of producing defective material. We feel our investment in inspection methods are economically justified, particularly so when the control system offers savings in time and cost.—**End**



Ethylene oxide

(From pp. 148, 150)

polyester and polyvinylidene chloride films are probably a good deal stiffer than polyethylene film and it is more difficult to tie a tight knot in them. The importance of the closure was dramatically shown by a comparison of the leakage in the 6-mil polyethylene bag closed with an overhand knot and one that was closed with string.

Not enough polyethylene bags were available to carry out large-scale statistically significant tests on rough handling. Testing on a limited scale indicated that a full-size 3- or 6-mil polyethylene bag packed with clothing and inflated with the ethylene oxide-chlorofluorohydrocarbon mixture could be dropped 5 ft. onto a concrete floor without bursting. The bags were punctured when dropped on sharp objects.

Decontamination experiments were carried out with full-size 6-mil polyethylene bags under the conditions used for permeability measurements. The results showed that decontamination of an expected level of contamination of clothing was accomplished in approximately 8 hours.

Decontamination bag requirements

A disposable decontamination bag should conform to the following requirements:

1. **Permeability**—The material from which the bag is made should have a low enough permeability to ethylene oxide to retain it until the contents of the bag have been decontaminated.
2. **Strength**—The bag should be strong enough (tensile strength, burst strength, seam strength) to withstand normal handling in use.
3. **Cost**—The cost of the bag, including the cost of the material and its fabrication, should be low enough so that the bag can be expendable.
4. **Transparency**—The bag should be transparent, or at least translucent, to facilitate opening the ampoule of ethylene oxide inside the bag after it has been loaded and closed.
5. **Flexibility**—The material from which the bag is made should be flexible **(To page 233)**

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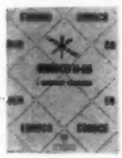

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enough to permit closing the bag tightly by some simple means such as tying it in a knot or tying it with a cord.

6. Storage—The bag must be unaffected by storage for long periods of extremes of temperature and humidity.

Heavy-gage (6-mil) polyethylene film was found to be suitable for use as the material of construction of the bag because, of commercially available plastics films, it conforms most closely to the above-listed desirable requirements. It is relatively inexpensive and is available in large quantities in the form of polyethylene drum liners.

Bags with only one heat-sealed seam can be readily fabricated from seamless tubing. It is flexible enough to insure a good closure. It contains no plasticizer to evaporate during storage.

Other plastics films were found to be superior to polyethylene in some respects, but inferior in others. Polyester film is much less permeable to ethylene oxide, but, of course, it is more expensive, less flexible, and more difficult to fabricate.

Polyvinyl alcohol film is relatively impermeable to ethylene oxide, but it is sensitive to moisture. Cellophone is also impermeable to ethylene oxide, but it is more subject to cracking at low temperatures. Plasticized polyvinyl chloride films, on the other hand, have greater permeability to ethylene oxide than do the polyethylene films.

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STATEMENT OF THE OWNERSHIP, MANAGEMENT, AND CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912, AS AMENDED BY THE ACTS OF MARCH 3, 1933, AND JULY 2, 1946, of MODERN PLASTICS, published monthly at Bristol, Connecticut, for October 1, 1960.

State of New York

ss.

County of New York

Before me, Notary Public, in and for the State and County aforesaid, personally appeared Alan S. Cole, who having been duly sworn according to law, deposes and says that he is the Publisher of MODERN PLASTICS and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the act of August 24, 1912, as amended by the acts of March 3, 1933, and July 2, 1946 (section 537, Postal Laws and Regulations), to wit:

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ALAN S. COLE, Publisher

Sworn to and subscribed before me this, 30th day of Sept., 1960.

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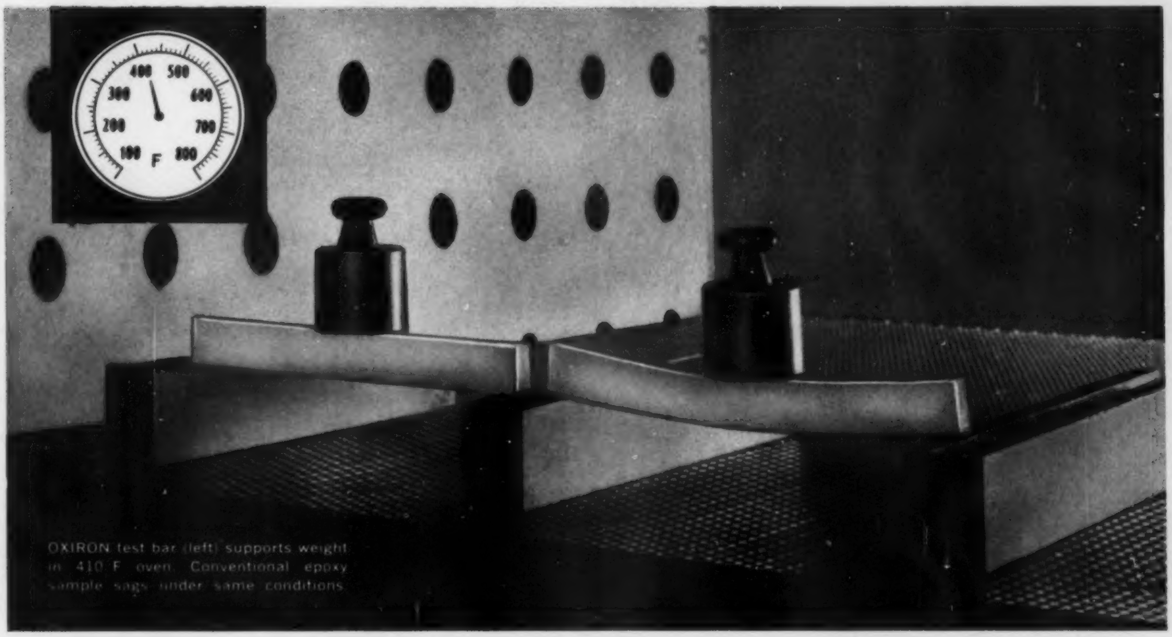

OXIRON test bar (left) supports weight in 410 F oven. Conventional epoxy sample sags under same conditions.

NEW OXIRON EPOXY RESINS OFFER UNUSUAL HIGH TEMPERATURE PROPERTIES

Even after long exposure at elevated temperatures, OXIRON resins have high flex strength and show little weight loss. Anhydride-peroxide-cured OXIRONS resist deformation over a broad range of temperatures. The gentle rise of their heat distortion curves demonstrates why these resins are acceptable for practical use at temperatures far above the heat distortion point (see diagram). In addition to high-temperature strength, OXIRONS have excellent electrical properties which they retain over a wide range of temperatures, show superior resistance to creep at elevated temperatures.

OXIRON resins are unique as epoxies, because they are epoxidized polyolefins rather than bisphenol-epichlorohydrin-type reaction products. Since they provide *10 or more* reaction sites per "monomer" unit, they have a remarkable degree of chemical versatility, as their cure reactions show. The resins are available in a wide range of viscosities and offer an unusual combination of advantages:

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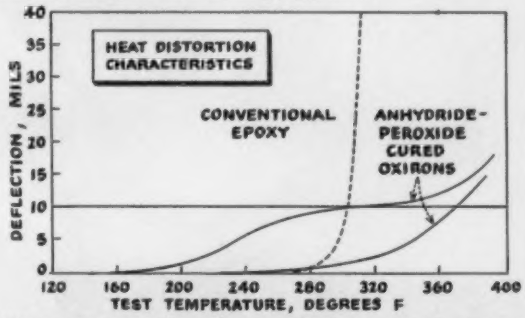
Economy: Low-cost curing agents may be used in high proportions.

Low Density: 20% lighter than ordinary epoxies—cured resins likewise have lower density.

Outstanding Chemical and Electrical Resistance: Excellent resistance to alkalis, acids and solvents—cured resins have good electrical properties.



This graph shows that—unlike conventional epoxy resins—the heat distortion curve of OXIRONS does not break sharply with temperatures . . . can be used above the heat distortion point itself.

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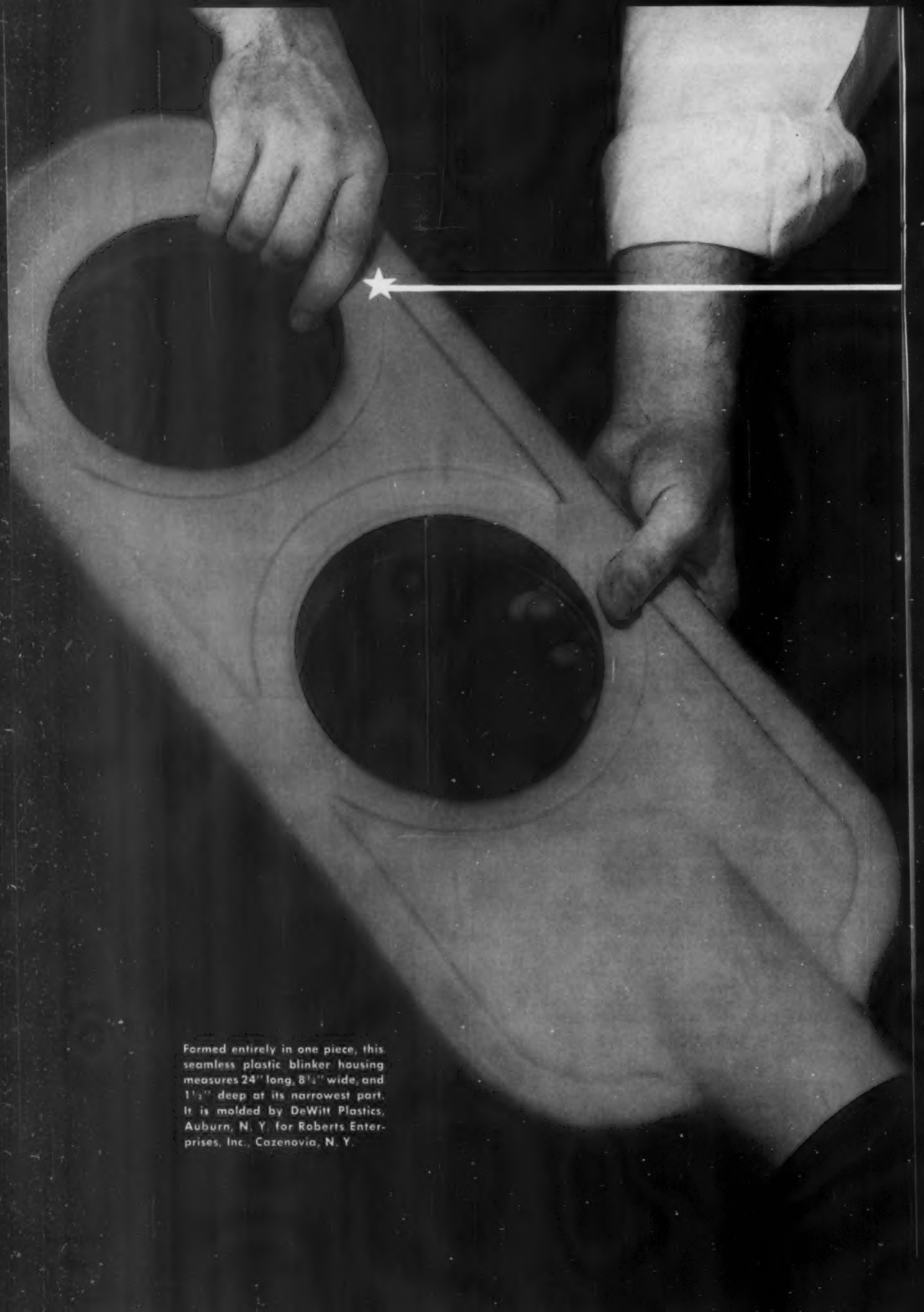
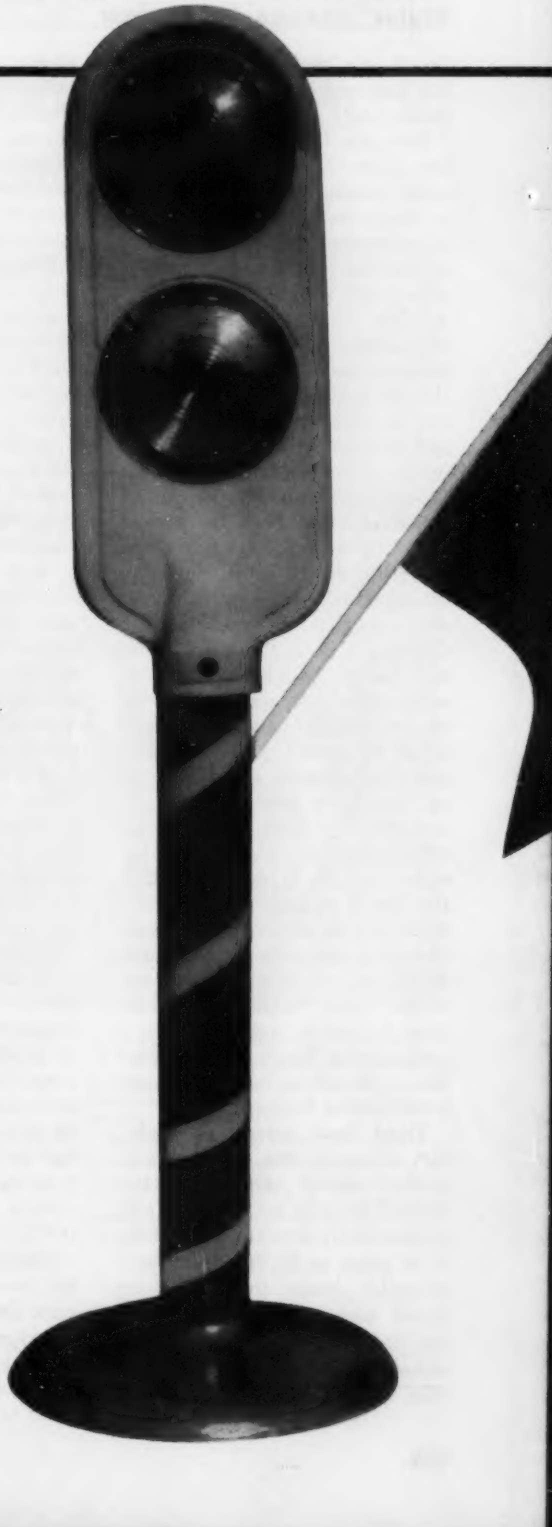


Formed entirely in one piece, this seamless plastic blinker housing measures 24'' long, 8¼'' wide, and 1½'' deep at its narrowest part. It is molded by DeWitt Plastics, Auburn, N. Y. for Roberts Enterprises, Inc., Cazenovia, N. Y.



THE PLASTISCOPE*

News and interpretations of the news

By R. L. Van Boskirk

Section 2 *(Section 1 starts on p. 39)*

November 1960

Mylar passes in review

Du Pont's Mylar polyester film has been making news on several fronts lately.

First, the U. S. inflatable satellite, Echo I, which can reflect radio messages back to earth and is clearly visible among the stars, is made of ½-mil metallized Mylar half the thickness of the cellophane on a package of cigarettes. Anyone who reads the papers knows that the properties of a material which could be used for this feat must be unusual, versatile, and have the highest possible performance value. But this versatility is not yet well enough known to designers and management.

Second, Du Pont is almost ready to open a new factory in Florence, S. C., which will virtually double capacity. Current production is centered at the Circleville, Ohio, plant. Almost no one, except Du Pont, knows exactly what this total capacity is. Market analysts have been having a ball for several years trying to make an accurate guess—several of them have settled on a consumption figure somewhere from 20 to 25 million lb. for all polyester film. It is estimated that Du Pont's capacity at Circleville alone will be well over 20 million lb. when expansion is completed. Since the cost is $1.80/lb. at the lowest level (there are several formulations at higher prices), a consumption figure for polyester film of 25 million lb. would mean a $50 million business.

Third, basic patents on Mylar film expire in 1961, although important related patents still have several years to go. The film was commercially introduced in 1954 at a price of $3/lb. Mylar is a polyester made from ethylene glycol and terephthalic acid—it has no relationship to the polyester resins used for reinforced plastics and plasticizers. It has essentially the same base as Dacron fiber, for which Du Pont has an estimated 125-million-lb. capacity. The dimethylterephthalate plants are believed to have a capacity of between 170 and 180 million pounds.

Cronar is another derivation from the above. It is a film base for use in photo films. Eastman Kodak has obtained a license from Du Pont and is making this particular type of film base under the designation Astar.

Goodyear and Minnesota Mining also have polyesters that are similar to Du Pont's, but they are supposedly in the copolymer category, containing a little isophthalic acid as well as terephthalic. The Goodyear film, Videne, is used mostly for laminating, and a copolymer is also the base for a textile yarn called Vycron. The 3M material is used for boil-in-the-bag film and in pressure-sensitive tape, but 3M's magnetic tape is supposedly produced from Mylar. Eastman is now marketing a polyester fiber called Kodel. Olin-Mathieson is also reported to be experimenting in polyester film and fiber. Any of these companies can obtain dimethylterephthalate from Hercules or Amoco.

Electrical and electronic insulation is the largest use for Mylar, consuming an estimated 25 to 30% of production. In many places a 1-mil film has replaced 8- to 12-mil rubber-filled cotton for service entrance cable with savings as high as $2.54 per 1000 ft. recorded. It is also used as slot liners and wedges in motors and as insulation in capacitors.

Fastest growing section of Mylar consumption is in magnetic tape. Total market for all kinds of this tape is thought to be approaching or even to have exceeded $50 million. Poundage of all types of magnetic tape is now getting up into the millions, but is not believed to be 5 million as yet. More than half is said to be Mylar, with cellulose acetate constituting most of the remainder along with some imported unplasticized vinyl chloride tape. Reportedly, 3M is producing unplasticized vinyl in Europe for magnetic tape to be used for export.

Mylar is particularly applicable for magnetic tape since it doesn't become brittle after aging and this keeps the film's "memory bank" clear and fresh. It can be threaded without breaking, doesn't require a plasticizer, and does not swell or shrink in either direction under most operating conditions. Du Pont has designed a special type of Mylar particularly suited to magnetic tape requirements to provide extra strength in a longitudinal direction. This formulation is called Type 2.

The potentials for growth in the television field are outstanding. Great quantities are used by TV stations where a half-hour show can be recorded on 2400 ft. of tape. An hour's show can be recorded on a 14½-in. reel of 2-in. wide tape. Since their introduction in 1957, over 300 recorders have been put in use in TV stations and 60 half-hour reels is the average inventory. There should be at least 700 recorders in use within five years.

Future growth is expected through the development of home video recorders. These will permit the owner to buy taped shows or record through his TV set, even when the owner is out. But this is several years away. Home movies, on video recording tape, with no need to send the tape away for processing, are also a possibility. Instrumentation tape for computers or business machines is in **(To page 240)**

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News about R/A SINCE 1913

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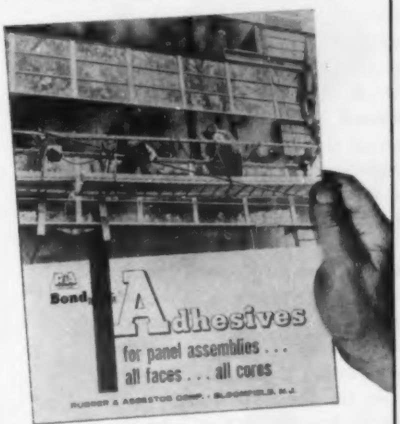

Profusely illustrated, 16-page Brochure No. 135 describes adhesives and production methods used in manufacture of curtain wall and other panel assemblies consisting of a variety of cores and faces. Contains test data and details of mass production bonding techniques. *Send for your free copy today.*

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THE PLASTISCOPE

(From page 238)

its bare infancy—magnetic tape for this purpose, based on Mylar, allows greater computer speed than the old-fashioned punched paper or cardboard system, in addition to providing more compact storage of data. The movement of magnetic tape as a programming device for automatic systems, such as machine tools, also shows great promise. This market is unpredictable, but the future for instrumentation is well assured and beyond imagination. Other plastics films, such as polycarbonates and polypropylene, will probably bid for some of the magnetic tape market in future days, but Mylar certainly has a big jump on the field.

Use of Mylar for metallic yarn, where it is used as a laminate with foil between two film layers or as a film with vacuum deposited aluminum on one side, was the second largest use for Mylar a year or so ago, but has fallen back due to fashion trends. It is used as a decorative item for dress goods, upholstery and other decorative features.

Another substantial use is drafting film where stability and long life make it desirable as a master copy for blueprints—it can even be washed without disturbing the special inks used for this purpose.

Use of this film as a packaging material has received reams of publicity but volume is modest—perhaps under 2 million pounds. The film has very good properties for big volume packaging—except one: cost. At $1.80/lb. it is difficult to compete with films that sell from 45 to 75¢/lb. However, it has been widely used as a laminate with PE for boilable bags and as a liner where a high degree of inherent strength and chemical resistance are required.

Insofar as boilable bags are concerned, Du Pont summarized the trade's outlook by predicting that the 1959 level of 69 million heatable pouches—calculated on a 6- by 9-in. average size—would grow to 100 million in 1960 and 300 million by 1965, including 75 million pouches for institutional use. The predominant pouch material, used today in an estimated 80% of all pouches, is a lamination or extrusion coating of polyethylene on polyester film. There are 107 heat-in-the-bag products that are now being offered to consumers by 43 packers.

Mylar is also used as a window for large display packages where a thin-gage Mylar replaces other heavier gage film at a saving. But until cost comes down, its broad application in packaging will be modest even though it can be used in very thin gages.

There are scores of miscellaneous uses. One of the newest of the attractive new uses is a radome cover with Mylar, nylon fabric, and pigmented Teslar (Du Pont's vinyl fluoride film) joined together in a laminate. A laminate over fabric or vinyl, or a metallized film is used for decorative purposes in automobiles, and a wide range of other fields. Laminates on wood or metal for surface protection are in development. An extruded vinyl windlacing in automobiles, with a Mylar surface, has received considerable attention. A weatherable film formulation for glazing for greenhouses, chicken houses, and other outdoor use is gaining in volume. Stationery supplies, typewriter ribbons, built-in stays for men's shirt collars, conveyor belts for sticky corrosive or abrasive products, are other miscellaneous uses. But it is questionable if all of these other applications put together will equal the volume of either electrical or magnetic tape uses.

However, there will always be unusual uses for Mylar to attract attention and create interest for this extremely transparent, durable, and strong film. Du Pont's expansion program certainly indicates confidence in future growth although it has never been expected to equal the growth of cellophane, which also started at an extremely high price back in the mid-1920's, since a comparable low production cost does not seem possible in the near future. There are rumors of possible new cost-cutting production methods. But these must remain rumors until proved otherwise.

Two plastics awards next year

To encourage better design and application of plastics, two awards will be offered in 1961.

The first will be the Bachner Award, which was established in 1957 by Chicago Molded Products Corp., "to stimulate and encourage the imaginative employment of plastic materials in the initiation and improvement of products and the production of those products."

This award, which will be presented in New York at the 9th National Plastics Exposition and National Plastics Conference in June 1961, consists of a trophy made of acrylic plastics, suitably engraved, designed by Jean Reinecke, famous Chicago industrial designer, plus an award of $1000 in cash which goes to the individual or individuals designated by the winning company as most responsible for the achievement. A suitable scroll will be presented to the industrial designer or designers designated by the winning company as responsible for the design.

The trophy for the first Bachner Award was presented in 1958, in Chicago, to Bissell Inc. for its rug-cleaning device, marketed under the tradename Shampoo Master. Three other companies were awarded Honorable Mention plaques for their entries.

The Bachner Award will be administered by a special committee headed by Harley J. Earl, Chairman of Harley Earl Assocs. Inc., and comprising also, Lee T. Bordner, Pres., Sierra Electric Co.; Charles A. Breskin, Chairman of the Board, Breskin Publications, Inc.; and Arthur J. Schmitt, Chairman of the Board, Amphenol-Borg Electronics Corp. Secretary for the Committee is William T. Cruse, Executive Vice Pres., The Society of the Plastics Industry Inc.

A panel of judges, to be chosen by the Bachner Award Committee, will select the winning applications. The competition closes March 10, 1961, **(To page 242)**

THE PLASTISCOPE

(From page 240)

is open to all manufacturers of products which employ plastics components or are totally plastic, and are molded, extruded, vacuum, or pressure formed. Fibers, flexible films, filaments, resins, and coatings are not eligible, nor are reinforced plastics applications.

Information and entry applications may be obtained through The Society of the Plastics Industry, 250 Park Ave., N. Y. 17, N. Y.

RP award—Since, under the rules of the Bachner Award, reinforced plastics are excepted, the industry will be interested to learn that a special award in reinforced plastics will be made by Owens-Corning Fiberglas Corp. at the Reinforced Plastics Conference and Exhibition, Edgewater Beach Hotel, Chicago, the first week in February 1961. For the past few years the Reinforced Plastics Div. of S.P.I. has awarded a gold ribbon to the company submitting the best piece of reinforced plastics molding, chosen on the basis of originality of application or design, the material selection, color, utility, moldability and appearance. Selection of the winner and runners-up is made by an impartial jury in the design, engineering and editorial fields.

The O-C-F Reinforced Plastics Design Award is Counterpoise, a crystal sculpture designed and made by Steuben Glass and will be awarded annually to the gold ribbon winner.

Entries in the Reinforced Plastics Exhibition should also be made through S.P.I.

Hemlock extract in adhesives

An extract of western hemlock bark can be used to obtain good results in cold-setting adhesives at low costs, according to Dr. F. W. Herrick, a scientist from Rayonier's Olympic Research division. This relatively new silvichemical HT-120 is a highly reactive polyphenolic intermediate that can be used as a partial replacement for resorcinol. The report revealed that adhesives containing from 30 to 60% of the bark product on a solids basis gave excellent bonding quality in Douglas fir laminates prepared under room temperature setting conditions. The new adhesive was obtained from HT-120 with resorcinol and phenol-modified resorcinol-formaldehyde resins to which a setting agent composed of paraformaldehyde and fillers was added. The new bonds were found to be fully resistant to delamination by water during several cycles of vacuum-pressure treatment followed by drying or by prolonged boiling water treatment. It is possible to modify or tailor-make adhesives of this type to fit the operational requirements of industry.

Metallized Mylar laminates

The availability of a new line of checkered metallized Mylar laminates in six different patterns has been announced by Lamart Corp., Clifton, N. J. custom laminators of plastics. Each pattern is available laminated to vinyl, cotton, or latex-impregnated paper, and is supplied in rolls to 54 in. wide, in lengths up to 100 yards.

Porous nylon parts

The development of porous nylon components which can absorb 15 to 50% by weight of oil has been announced by The Polymer Corp., Reading, Pa. The filled nylon parts are said to hold the oil under extremes of pressure, temperature, and acceleration. Approximately 20% of the oil is retained even after centrifuging at 15,000 G's. The nylon components, known as microporous Nylasint 64HV, are formed by cold pressing and sintering specially processed nylon powders by techniques similar to those used in powder metallurgy. The oil-filled parts are claimed to operate for very long periods at a frictional coefficient as low as 0.01; conventional oil-filled metallic bearing materials, in contrast, will gradually lose their lubricating properties.

Applications for the oil-filled material include bearings and wear parts where low frictional lubricated surfaces must be maintained over indefinite periods without subsequent lubrication. The material reportedly retains nylon's inherent abrasion resistance and non-galling surface characteristics.

In other proposed applications, fluids other than oil, e.g., ink, can be used to fill the porous nylon. Microporous Nylasint components are pressed and sintered in Detroit, Mich. by Halex Corp., a Polymer subsidiary, as well as in the plant at Reading.

Polyethylene formulations

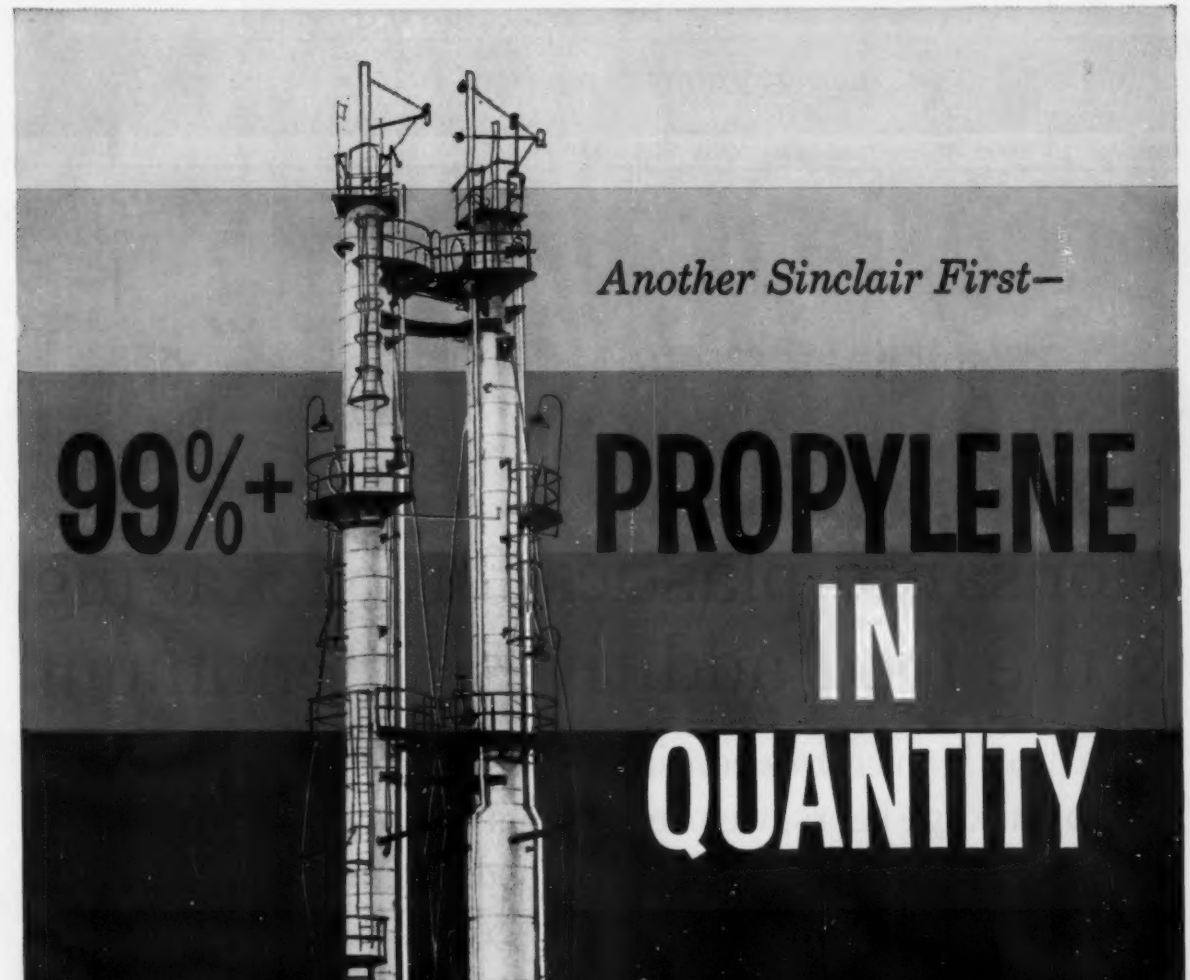
A recent announcement that Koppers Co. was adding 15 new low- and medium-density polyethylene formulations to its line, gives an indication of the constantly increasing and complex number of patterns that both material producers and their customers must learn how to deal with. Koppers' complete PE line now has 33 formulations.

The new resins are each tailored for a specific purpose: fast flow injection molding; stiff molded parts; extrusion-blown film where clarity and high impact are desirable; chill-roll film extrusion; films for textile use, such as tablecloths; closures for cans and bottles, as well as pressure buttons on aerosol cans; injection molding where quick mold release is important; black master batch for blending; and low-density-pipe grade resin.

Vocational degree in plastics

At the Society of the Plastics Industry's Pacific Coast Conference last spring, the Educational Committee of the Society was directed to proceed with the establishment of new facilities for vocational education in plastics. As a result of the Committee's efforts, the Los Angeles Trade Technical College has agreed to start a 2-year course in plastics leading to a degree of Associate in Arts (A.A.).

David Rome of Olympia Plastics Co. Inc., Los Angeles, Calif., was made chairman of the Equipment Committee and is arranging for outright gifts or loans of equipment, in order to outfit the laboratories and training shops. The Committee hopes to have all contributions **(To page 246)**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The Status of Monsanto Plastics—November, 1960

PRODUCTS	BASIS FOR RECOMMENDED USE IN FOOD PACKAGING
LUSTREX® STYRENE PLASTIC	
General Purpose Molding Grades: Hi-Flow 55, Hi-Flow 66, Hi-Flow 77, Hi-Heat 99	Generally recognized as safe and prior sanction by FDA.
Impact Molding and Extrusion Grades: Hi-Test 42 Type, Hi-Test 88 Type, Hi-Test 48 Type, Hi-Test 180 Type	Extension granted by FDA until March 5, 1961 (Long term feeding studies highly favorable)
MONSANTO POLYETHYLENE (NATURAL) — Injection and Blow Molding Grades: 51, 52, 60, 80, 705, 805, 935, 9752; Film Extrusion Grades: 30, 31, 32, 33, 34, 37, 38, 706, 10406, 13406, 18300, 19706, 23406, 25706, 26706; Extrusion Coating Grades: 406, 537, 73	Prior sanction by FDA.
VUEPAK® F CELLULOSE ACETATE	Generally recognized as safe and prior sanction by FDA.
OPALON® VINYL RESINS: 300, 330 FM, 300 FM, 410	Prior sanction by FDA.
Polyvinyl chloride acetate copolymers: 506, 510	Prior sanction by FDA.
SCRIPTITE® Paper and Paper Board Coating Resins: 50, 52, 53, 54	No reasonable expectation of migration when used as wax-holdout resin.
40 (Urea Resin)	Prior sanction by USDA Poultry Division as wet strength poultry package resin.
33 (Melamine Resin)	Prior sanction by FDA.
RESIMENE® 883 (Melamine Resin)	Prior sanction by USDA Meat Inspection Division for lard cans.
U901 (Urea Resin)	Prior sanction by FDA.
LYTRON® Latex Paper Board Coating Resins: 6, 6-A	Not subject to regulation when used in single use disposable containers. Petition being prepared for regulation of all food packaging uses.
RESINOX® PHENOLIC RESIN P-97	Prior sanction by USDA Meat Inspection Division for lard cans.

DEFINITIONS

of terms important in understanding the Food Additives Amendment.

Food Additives Amendment—1958 Amendment to the 1938 Federal Food, Drug and Cosmetic Act. It requires, for the first time, that any chemical compound in food, whether intentional or incidental, must be proved safe before the food is put into interstate commerce. The amendment became effective March 6, 1960.

Food Additives—All chemical compounds in food are *not*, however, in *legal* sense food additives. Compounds with prior sanction or which are generally recognized as safe are specifically excluded by the new statute from the category of food additives.

Prior Sanction—Before the 9/6/58 enactment of the Food Additives Amendment, the Food and Drug Administration and divisions of the United States Department of Agriculture had only limited authority to approve use of chemical compounds in foods. Favorable response to a request for approval normally meant an informal letter of no objection—now classified as a prior sanction—exempt under the new amendment.

Generally Recognized as Safe—The FDA interprets this to mean that it is the widely held opinion of acknowledged authorities that a given chemical compound is safe in human food. FDA has published in the Federal Register, lists of compounds which are considered generally recognized as safe.

No Reasonable Expectation of Migration—It is obvious that chemical compounds not in food cannot be food additives. But the definition of "zero" content requires scientific judgment. No reasonable expectation of migration (of pharmacological significance) realistically recognizes that infinitesimally small amounts of certain chemical compounds may be and generally are present in processed foods without hazard.

* * *

A special report on food packaging colorants has been prepared for package manufacturers using colorants in their packages. For this report, write to Monsanto Chemical Company, Plastics Division, Room 773, Springfield 2, Massachusetts.

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installed by Feb. 1, 1961, when the first semester of the plastics course begins.

Price drops

Reductions of up to 10% on some varieties of plastics are announced in the just-published catalog of Cadillac Plastic & Chemical Co., warehouser and distributor of plastics films, rods, tubes, sheets, and blocks. The price of nylon rod, bar, tube and sheet has been reduced about 10%, the price of Mylar polyester film has dropped as much as 20%, according to the company. Only two plastics in the 64-page catalog reflected significant price increases. Flexible vinyl prices rose about 2¢/lb., while polystyrene sheet increased 5¢ in price. All other prices were virtually unchanged.

Coated fertilizer

Plastic-coated fertilizer for lawns and gardens was suggested to a session of the American Chemical Society's 138th national meeting by Dr. Kirk Lawton, a soil chemist from Michigan State University. Coating conventional fertilizers with various plastics slows down the rate at which they release their various constituents to the soil. At the same time, the coating prevents plants from feeding more quickly or heavily than they really need to, he said.

Laboratory and greenhouse experiments carried out by Dr. Lawton showed that plastic coatings, such as vinyl acetate, paraffin, acrylic resin, and polyethylene, reduced the rate at which soluble fertilizers dissolved in soils. For example, a coated fertilizer lost only 5.4% of its potassium while the same amount of uncoated fertilizer lost 81.3% in the same period of time, he said.

Different chopped strand mat

A fibrous glass chopped strand mat, said to increase laminate production speed and end-product quality, has been introduced by Johns-Manville. Called Garanmat, the new product is made of continuous filament fiber glass roving to which Garan binder has been applied. The roving is chopped into lengths of approximately 2 in., formed into a mat with random pattern and bonded with plastic resins. It is claimed to wet out 3 to 5 times faster than other products now in the field (reducing the amount of rolling and brushing required), be more uniform in fiber distribution and weight, and to have a pure-whiteness that will impart no off-color to finished laminates.

Plastics in India

Present consumption of plastics raw materials in India is 12 to 14 thousand tons per year. At least a five-fold expansion is desirable, according to Shri Shadilal Jain, chairman of the reception committee at the last India Plastics Manufacturers' Conference. His tabulation of plastics totals in India is shown in the Table, below.

The country now has 150 modern plastics factories in addition to innumerable small units of the cottage industry scale. Compression presses number about 300, with a pressure capacity of 35,000 tons; injection presses total 500, with a combined shot capacity of 1200 oz.; extruders number 150; there are two calendering machines. Export of plastics goods is 10 times greater than three years ago.

Vitel coatings

A new polyester coating resin, said to have an exceptional range of properties, has been introduced by the Goodyear Tire & Rubber Co.'s Chemical Division, under the tradename Vitel. This is Goodyear's third entry into the field of polyester materials. The others are Videne polyester film and a textile fiber resin. According to H. R. Thies, general manager of the division, advantages of the new resin are resistance to abrasion, ultraviolet rays, chemicals and weather; excellent adhesion, clarity, electrical properties, and the ability to bind pigment. "The applications with the most promise are as clear, tinted, or colored coatings for metals and such automotive hardware as bumpers and wheel covers," he states. "Other important areas of use will be as protective and decorative coatings for architectural aluminum and aluminum foil, and in wood stains, toners, primers and finishes." Applied to paper, he said, Vitel coatings improve gloss, wet strength, and the rate of vapor transmission, and make **(To page 248)**

Table: Consumption of plastics in India

Raw material	*1960 Current annual demand*	*1966 Anticipated annual requirement*	*Target capacity*
	tons	*tons*	*tons*
Phenolic molding powder	2,500	5,000	6,875
Urea molding powder	900	2,500	3,125
Cellulosics	1,400	4,000	5,000
Polystyrene	4,500	12,000	15,000
Polyethylene	5,000	20,000	25,000
PVC resins & composition	4,000	12,000	15,000
Cellulose nitrate sheets, rods, and tubes	700	1,000	1,250
Laminates (phenolic)	600	2,000	2,500
Nylon (molding & monofilaments)	50	500	625
Acrylics (molding powder, sheets, rods, and tubes)	300	900	1,125
Polyesters	—	1,500	1,875
Foam plastics (polystyrene)	500	2,000	2,500
Polyurethane	—	1,000	1,250
Other types	—	2,000	2,500
Total	**20,450**	**66,400**	**83,625**

DOW Plastiatrics

DOW'S CLINICAL APPROACH TO HEALTHY PLASTICS APPLICATION

ACCELERATED AGING TESTS HELP EVALUATE PLASTICS' WEATHERABILITY

The weatherability of plastics materials is most accurately determined by exterior exposure testing. However, accelerated (machine) aging is often valuable for initial screening, and usually a correlation of results between outdoor and indoor testing can be established.

In selecting plastic materials for engineering use, major considerations are maintenance of adequate strength and acceptable appearance. Both properties are degraded during weathering, a complex process involving interactions of sunlight, air, humidity, wind, rain and heat. Since the full effects of variable climates cannot yet be duplicated in the laboratory, outdoor testing is carried out at stations where extreme weather conditions are the rule. Fig. 1 shows the relative effects of outdoor exposure on three different Dow polyethylene formulations.

Accelerated aging (or weathering) test equipment is designed to accelerate the rate of aging – that is, to produce the same effects as the normal aging process in considerably less than normal time. Two widely-used devices are the "Fadeometer" and "Weatherometer." The Weatherometer uses a carbon arc with intermittent water spray; the Fadeometer an arc only.

An S-1 sunlamp is also valuable for conducting laboratory aging tests. Fig. 2 shows relative severity of accelerated aging equipment. Initial evaluation of Dow plastics is first made in the Fadeometer. Materials which retain good strength and appearance after 2000 hours in the machine are considered suitable for further testing outdoors.

In evaluating Zerlon® 150, a new Dow plastic, exposures were made in the Fadeometer, in Florida and Arizona. Changes in luminous transmission were plotted at varying time intervals for each exposure station. It was found that 1600-1800 hours in the machine produce the same effect on luminous transmission as one year of weathering at the outdoor stations. Similar relationships were found for certain other properties–such as impact strength – but without an across-the-board correlation. Although such relationships are close approximations, weathering data are still required.

It is possible to predict weatherability in areas having different climates by using a measure of langley units (actinic radiation of one gram calorie per cm^2). Exposures are first conducted in a selected area and property losses established as a function of the number of langleys (amount of incident light energy). Then, on a basis of pre-set requirements for residual strength and appearance, service life of the plastics material in other areas can be predicted by determining relative langley ratings for those areas.

Most plastics have good aging characteristics for indoor use. The two most significant factors in degradation are heat and light. For heat, the most important consideration is a safe continuous operating temperature. The effects of light are more varied, with the rate of degradation increasing as ultraviolet energy content rises. Neither incandescent nor fluorescent light degrades plastics appreciably under ordinary conditions, but even filtered sunlight contains relatively damaging UV levels, depending on severity of the climate.

Germicidal ultraviolet lamps commonly used in appliances can be harmful to component plastic parts. UV radiation is relatively intense, and the extent of damage encountered will depend on type, size and location of the bulb, and also the type of plastic chosen. Studies on property retention and light stability should be conducted with prototype parts prior to settling on a final material and finished design for full scale appliance production.

Dow Plastics Technical Service Engineers work with designers and plastics engineers, assisting in materials selection and providing information on design, molding and finishing of plastic parts. Also available are detailed data from continuing Plastiatrics Studies on weathering and aging of plastics materials. For these data, and for information on Dow plastics, write THE DOW CHEMICAL COMPANY, Midland, Michigan, Plastics Sales Dept. 1804CS11.

FIG. 1 RELATIVE EFFECT OF OUTDOOR EXPOSURE ON POLYETHYLENE FORMULATIONS

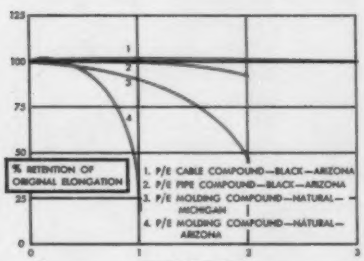
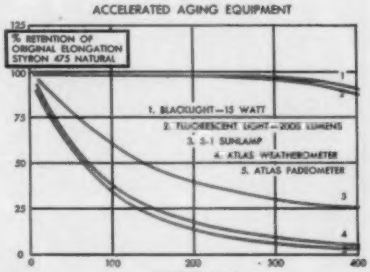


FIG. 2 RELATIVE SEVERITY OF ACCELERATED AGING EQUIPMENT



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(From page 246)

excellent prime adhesive coats, electrical coatings, inks for laminating films, and binders for magnetic recording tapes.

According to the company, one of the formulations has received approval under the Pure Food and Drug law, making it applicable for use in the packaging industry. The coatings can be applied by spraying, dipping, roller coating, brushing, hot melt, knife coating and most other methods of commercial importance.

Acrylic-based coatings

Valchem, a unit of United Merchants & Manufacturers Inc., has introduced the first of a series of acrylic-based polymer emulsions under the designation Acrival A-37. The new emulsion is suggested by the company for grease-resistant coating on paper and paper board, as well as a bonding agent in the non-woven fabrics and in textile finishing.

Liquefying PE without heat

A new molecular structure resulting from the successful formulation of liquefied polyethylene or polypropylene resins with urethane is claimed by Delka Research Corp. of New Jersey. Resins so produced remain in liquid form without heat and can be further processed into protective coatings and other products at low cost, the company states.

Dr. Rene Kales, Czech-born director of research for Delka, is the discoverer of these formulations. New manufactured products based on Dr. Kales' discovery and the new techniques which will evolve from their use will apply to many different fields, including a variety of protective coatings, elastomers, foams, fibers, films, etc.

Catalysts for polyolefins

Alkyls to be used as catalysts for the production of polyolefins and as intermediates are now in semi-commercial production by Texas Alkyls Inc. The four new compounds are tri-n-propylaluminum, tri-n-butylaluminum, tri-n-hexylaluminum, and triisohexylaluminum (tri-2-methyl-pentyl-1-aluminum). This is believed to be the first time that these compounds have been available in other than research quantities.

Anderson Chemical Div., Stauffer Chemical Co., is exclusive sales agent for Texas Alkyls Inc. Samples and technical data are available from Anderson offices at New York, N. Y. and Weston, Mich. One-half lb. samples range in price from $25 to $50.

Custom design instrument cases

A new division for the manufacture of custom-designed plastics instrument cases has been created by Hollywood Plastics Inc., Los Angeles, Calif. manufacturer of plastic tote trays. The cases are formed of ABS sheet and offer the strong construction, light weight, and handsome leather-like appearance required for specialized cases of this type.

Stress crack resistance

A polyethylene molding resin said to have exceptionally good resistance to environmental stress cracking has been developed by Spencer Chemical Co. under the designation Poly-Eth 4204. Spencer says that the unusual stress crack resistance is a direct result of its polymorphous technique to produce a molding-grade resin. The polymorphous concept was introduced by Spencer early this year in connection with film resins. Basically, it involves the action of a resin when formed to produce a controlled molecular pattern and a balance between the crystalline and non-crystalline elements of the material. Applied to a molding resin, it reportedly has had desirable effects on both the stress crack resistance and processing properties.

A 0.919-density material with a melt index of 1.4, 4204 is said to resemble materials of higher melt indices in processing, thereby allowing faster mold filling and reducing cooling time.

For foundry uses

A complete line of epoxy resins especially formulated for the foundry and tooling industries has been introduced by Allaco Products, Cambridge, Mass. Foundcast 101 is intended for **(To page 253)**

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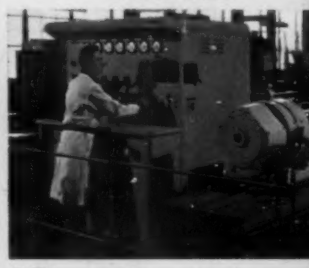

G.E.'s service network offers three-way 'round-the-clock' assistance: start-up service, productive maintenance assistance and complete repair service.

THE PLASTISCOPE

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making epoxy molds and patterns. The compound is said to hold close dimensional stability during room temperature cure, have good machinability, easy foundry mold release and easy draw.

Sandbind 201 is designed for molds for casting epoxy duplicates. Used in conjunction with Faceboat 301, the material is said to produce molds of greater durability than plaster. Faceboat 301 is easily applied with a brush and produces high surface smoothness.

Multicast 401 is a compound for making epoxy jaws and chucks with high resilience and impact strength, high tensile strength, and good dimensional stability. It cures at room temperature. Layup #501 is used to make epoxy molds and patterns with fibrous glass and is said to provide complete resin to glass penetrability and hard surface finish.

The company has also formulated a fluorocarbon dispersed in a liquid vehicle. Called Surepart, this parting agent is said to be stable from −60 to 450° F.

Furane plastic pipe

A new line of easy-to-install reinforced furane plastic pipe especially suited for use in the processing and transferring of acids, alkalies, and solvents is now manufactured by Cornelius A. Rauh & Assocs. Inc., Akron, Ohio. Called Eonite, the new chemical-resistant pipe is strong, dimensionally stable, and can carry hot corrosive liquids and gases at temperatures up to 300° F. and at pressures up to 150-p.s.i.g. without distorting or deteriorating. It permits flow rates that can run as much as 20% greater than steel pipe of the same size, the company states. Since it will not react chemically with the material it carries, there is no danger of product contamination. The company also reports that the pipe will withstand weathering and does not deteriorate with age. Physical and chemical properties are unimpaired by sunlight, moisture, and outdoor atmospheric conditions. A furfuryl alcohol resin, Durez 16470, **(To page 254)**

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produced by the Durez Plastics Division of Hooker Chemical Corp., is used for the pipe.

It is designed for leak-proof field assembly with the patented Rauh Ring Lock Joint, which includes two cast iron standard A. S. A. flanges, two 4° tapered rings, and a hard asbestos gasket impregnated with neoprene and graphite. No cements, solvents, threading, welding, or special techniques are required. Pipe can be cut to length with a hacksaw or brick saw, and a screwdriver and wrench are the only other tools needed for quick installation. Depending on size, the pipe is currently priced at from $3.45 to $15.40 per foot, f.o.b. Akron, Ohio.

Eonite pipe is extruded onto special mandrels. The extruded solidified resin is then reinforced with 90°-angle wrappings of woven borosilicate glass fabric, with excellent strength and chemical resistance characteristics. Following extrusion of a top coating of the furane resin, the completed pipe is then autoclave-cured under pressure at 450° F. to effect complete conversion of the resin.

Affiliates with Dutch company

Pennsalt Chemicals Corp., Philadelphia, Pa., and N. V. Fabriek van Chemische Producten, Vondelingenplast, Holland, have announced a plan by which Pennsalt will acquire a substantial interest in the Dutch chemical firm, which makes plastics films, dyestuffs, pesticides, rubber chemicals, formic and oxalic acids and their derivatives, and a host of organic chemical intermediates. Pennsalt, a leading producer of fluorine chemicals, including a recently announced high-performance fluorinated plastic, also makes chlorine and caustic soda, alkyl amines and derivatives, and other industrial chemicals.

Vinyl-glass cloth fabrics

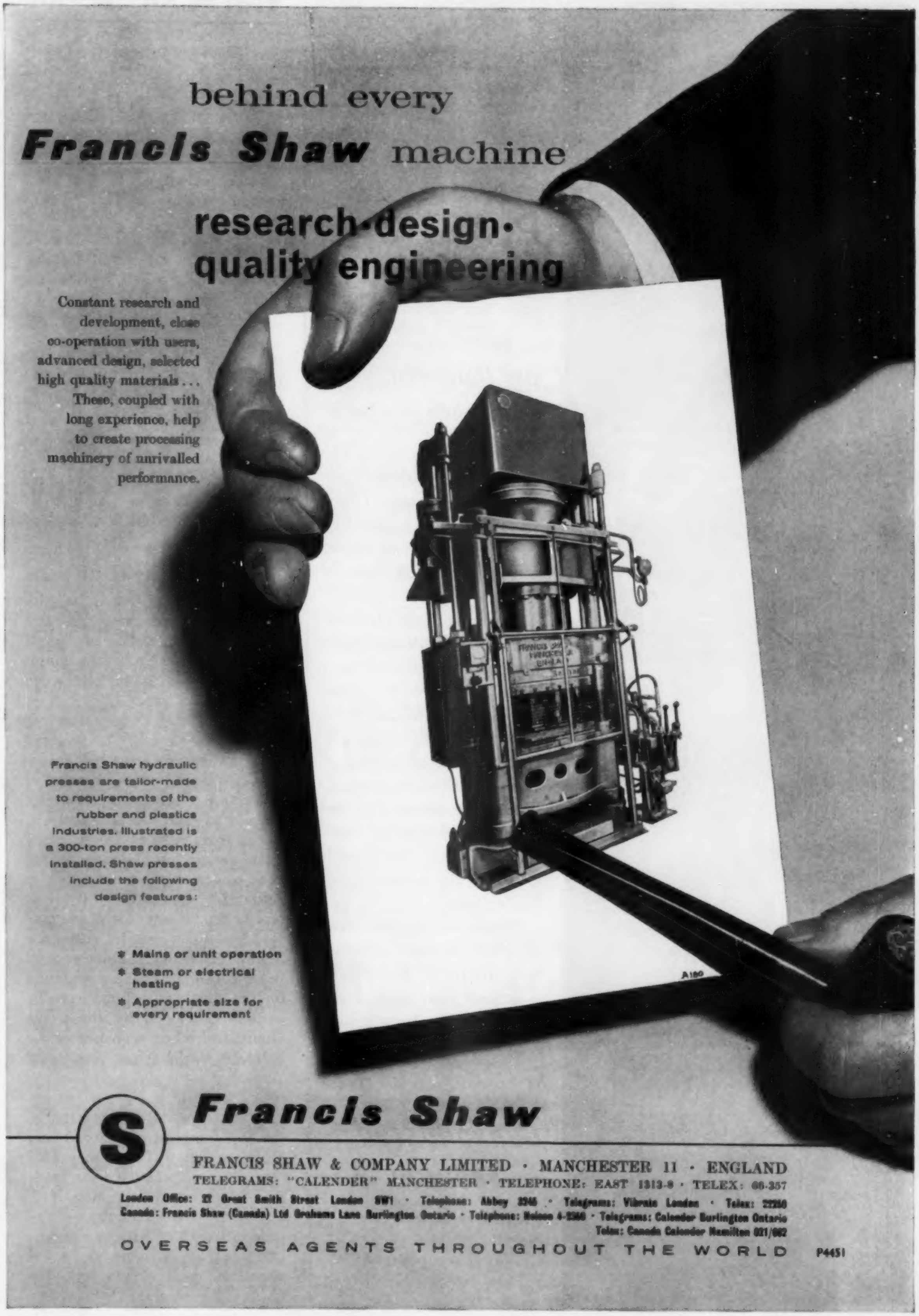
Three-dimensional patterns, in a special weight vinyl, bonded to a glass-cloth backing are now available from L. E. Carpenter & Co. Inc., New York, N. Y. Called Vicrtex VEF vinyl drapery fabrics, the new material is said to be fire-retardant and is expected to find applications in home, office, theatrical, commercial, industrial, and institutional decorating. According to the company, these drapery fabrics are unaffected by atmosphere and climate, will never fade, crack, snag or stain, and have such dimensional stability that they will never stretch.

Bonding Teflon

A fast, simple method of bonding Teflon to itself and to other materials has been developed by W. L. Gore & Associates Inc., Newark, Del. Basis of the new system is an active form of sodium in solution. Called Tetra-Etch, it reacts with Teflon to form a carbonaceous film on the treated surface. This film then serves as a means of anchoring adhesives to the Teflon. The compound is said to be compatible with a variety of adhesives, including epoxies, phenol formaldehydes, and most of the rubber and silicone types. Since no special equipment is needed, the process is suitable for field application as well as for in-plant work. It also lends itself well to batch-type and production line techniques, especially for continuous treatment of strip or Teflon-coated wire, the company states. The etchant was reportedly effective on Du Pont's new Teflon 100X (FEP-fluorocarbon resin) as well as on the widely used TFE type. While the reaction normally is a little slower on 100X, this can be offset either by heating the solution to between 122 or 140° F. or by heating the Teflon to about 212° F.

Profit in reinforced plastics

In a report to stockholders, Robert S. Morrison, president of Molded Fiber Glass Body Co., stated that the company showed a 170% increase in profits before taxes on a sales increase of 53.6% for the three months ending May 31, compared to a like period last year. Profits for the three months were $316,634, compared to $117,299 for the same 1959 period. In addition, the Molded Fiber Glass Boat Co., Union City, Pa., subsidiary, registered a 45% in- **(To page 256)**



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OVERSEAS AGENTS THROUGHOUT THE WORLD
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(From page 254)

crease in sales volume for the 1960 model year, September 1 through June 30. Mr. Morrison stated that the profits for the MFG Boat Co. were up $290,000 for the 10 months, compared to the same period of the previous year's boating season.

Higher volume of business to date in 1960 and the predictable business for the Fall, including a retooled fibrous glass body for the new 1961 Corvette sports car, are expected to increase earnings for the balance of the year. The company is boosting its capital expenditures during 1960 to between $600,000 and $700,000. Last year the company started production of its own polyester resin. Now, construction is underway that will double the original 5-million-lb. capacity by the fourth quarter of the year.

In production: 40-ft. RP boats

After a season of testing its pilot model, Chance & Associates Inc. has started production on the 41 ft. models of its Sea Fleet line of luxury fibrous glass reinforced plastics cruisers.

When a customer pays upwards of $24,000 for a craft, he is going to want proofs and guarantees that it will do what is expected of it and that it will endure abuse by both nature and man. In the midst of all current discussion about boat testing and standards for boat construction, the Chance & Associates' approach to the problem is interesting. Although material and fabrication costs are higher, the Waldorf, Md. company bases consumer boat construction on the toughest military specifications developed by the Coast Guard and other branches of the services which buy boats of similar design.

The hulls of the Sea-Fleet series are essentially the same as the now famous Coast Guard boat 95329, which in September 1959 was given exhaustive tests in 6- to 8-ft. waves off Cape May, N. J. Driven into the waves, time-after-time, at 20 knots with accelerometer readings showing 30 Gs (30 times the pull of gravity), the CG 95329 boat came through and

returned to the yard under her own power, with no more damage than a few fittings which had worked loose. Instrument readings show that the model was getting nearly twice the maximum pounding that the Coast Guard has given steel and wooden boats in such tests.

Hulls, bridge top, foredeck, and after-cockpit decking of the Sea-Fleet line are made by hand lay-up in female molds. Many smaller parts, such as control stands, bulkheads and battery boxes, are vacuum-bagged. Both glass cloth and woven roving are used, with mat occasionally in fillets and flanges. The resin used is Hetron 354 fire-retardant resin, applied with a double nozzle catalyst gun. Assembly is by epoxy bond and fittings by mechanical fastening. After-cockpit has vinyl-coated fibrous-glass decking. Vinyl, backed by rubber and urethane foams, is used for overheads. Cabinet work is either walnut or mahogany Formica.

While the 41-ft. Sea Fleet is the largest RP craft in full production, it by no means marks the size limit for plastics hulls. Word comes to us from England that one company there is working on a 61-ft. custom job.

Polycast Corp. sales

Sales of The Polycast Corp., Stamford, Conn., a producer of cast acrylic and other plastic sheets, reached a record high of more than $1 million in the first six months of 1960, according to John O. Beattie, president. This is an increase of 25.4% over sales in the first half of 1959. Net income in the current year's first half was $65,880. For the comparable 1959 period, net income was $60,538.

Urethane foam for flotation

Rigid polyether urethane foam will be the only type of flotation material used in the 1961 line of pleasure boats made by Brunswick Boats, a division of Brunswick Corp. The company manufactures Larson Boats and Cutter Boats, as well as Owens Fiberglass Outboards.

Besides going onto the hull and deck, the rigid urethane foam will be sprayed into the gunwale sections of the large boats for structural and flotation purposes, and on the underside of inboard motor covers to cut motor noise and make the cover floatable. Brunswick will also use flexible urethane cushioning on every boat. Some of the big boats will have flexible urethane foam side panels in the cabins.

Eastman-Chemical accident

There have been no major interruptions of delivery of goods as a result of the fire and explosion at the Eastman Chemical Products Inc., plant at Kingsport, Tenn. on Oct. 4. Fifteen persons were killed and approximately 200 were injured, most of the latter by flying glass.

"The preliminary estimate of the damage to our buildings and equipment, including the aniline plant—which was totally destroyed—may exceed $4½ million," says Pres. James C. White. Although an investigation is still underway, cause of the blast has not yet been determined.

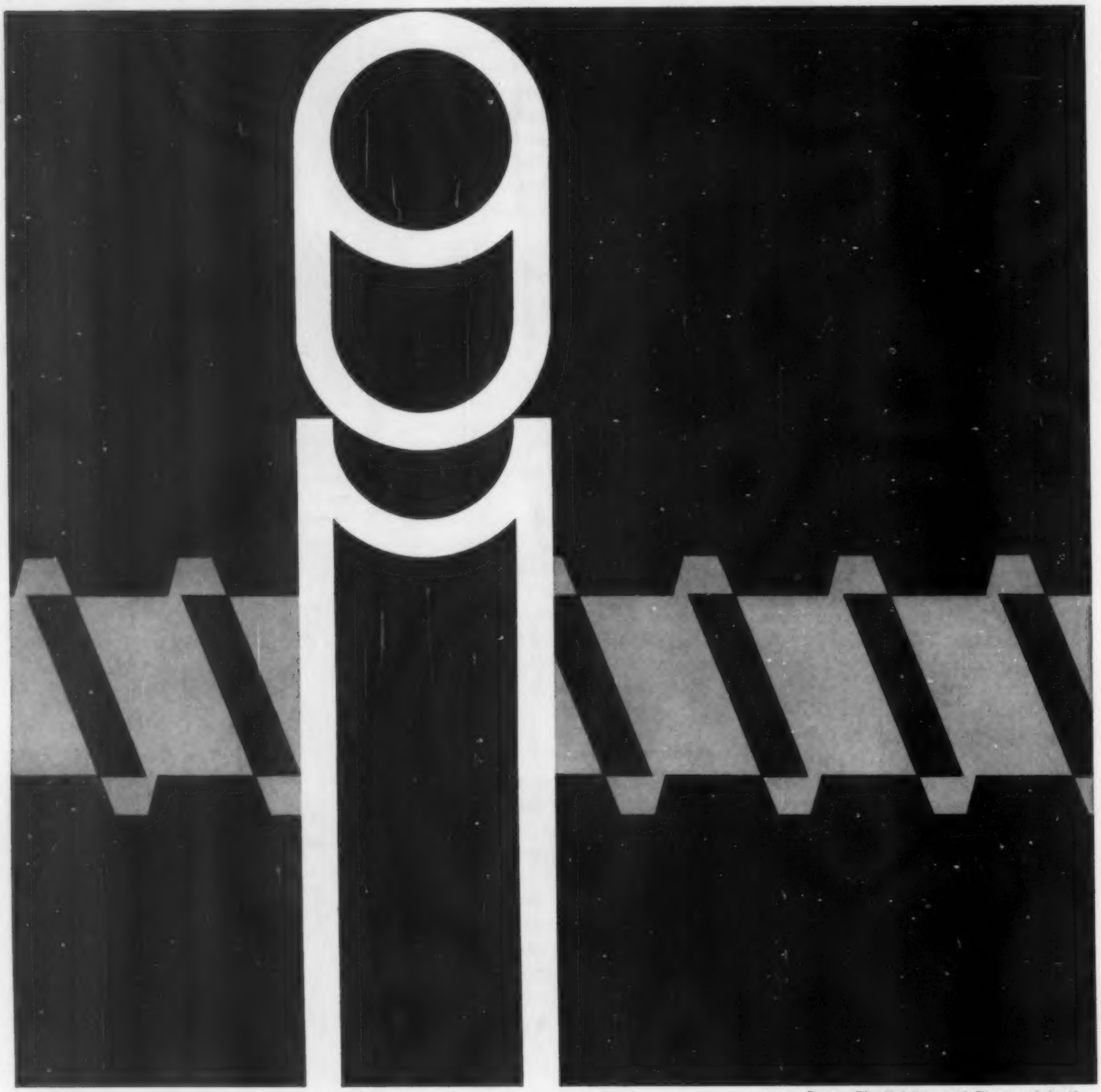
Price per cu. inch

A serious error of transmission in this column occurred in September when the price per cu. in. of plastics was compared with that of metal. The price printed was listed in dollars, when it should have been in cents. The proportion, of course, was the same since the price of metals was also given in dollars, but the reader's attention should be called to this factor.

In a recent revise of these figures, which takes account of price changes, here are some of the results. The price per cu. in. of various materials is now as follows: polyethylene, 0.91 to 1.31¢; Delrin, 4.11¢; methacrylates, 2.34¢; nylon general purpose, 4.04¢; polystyrene g.p., 0.82¢; polystyrene high impact, 1.08¢; ABS resins, 1.80¢; polycarbonate, 6.50¢; aluminum, 2.36¢ and 2.41¢; brass 7.14¢ and 9.01 cents.

PE film grade resins series

Two new series of polyethylene film grade resins have been developed by The Dow Chemical Co. PE 660E series is an intermediate-density (0.930) resin engineered for over- (To page 259)



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wrap and thin-gage applications such as garment bags. PE 561E through 564E are low-density (0.921) materials suitable for produce, textile, and soft goods bags where impact strength and clarity are important, according to Dow.

Both series of resins are said to exhibit excellent drawdown and processing characteristics that make them suited for flat film extrusion by either water bath or chill roll techniques, as well as for blown tube extrusion.

J. P. Frank companies consolidate

In order to coordinate the various activities of his several operations, J. P. Frank has merged his three companies, J. P. Frank & Co., Presto Plastics and J. P. Frank Chemical Co., into one organization that will be known as J. P. Frank Chemical & Plastics Co. Inc. The firm, which started as Presto Plastics Products Co. to produce vinyl chloride film and sheeting during World War II, produces not only vinyl and polyethylene film but also manufactures vinyl chloride resins, stabilizers, and plasticizers. The film division is a completely integrated operation producing film and sheet and also printing, embossing, and laminating to meet the requirements of its customers.

Among the various resins produced by Frank is a copolymer resin for records and a vinyl stearate-chloride copolymer. Vinyl chloride-stearate copolymers have been known and used sparingly in the United States for many years but Frank is the only company which publicly talks about them. Stearate reportedly helps to produce a resin that is easier to work than the usual standard plasticized resins and is in some measure an internally plasticized material. Mr. Frank states that the organizations' dollar volume in 1960 was 20% over 1959, but that profits have not increased correspondingly.

Other officers of the company, in addition to president J. P. Frank, are Henry Hilsenroth, v.p., and Morton Frank, **(To page 260)**

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secy.-treas. The new location of company headquarters will be 390 Fifth Ave., New York, N. Y.

New companies

Sparling Plastic Industries Inc., 1730 Howard, Detroit, Mich., has been formed as a vacuum coating, plastic decorating, and painting company. Another phase of operation will be the production of clear epoxy castings. **Robert D. Sparling** is president, and **Henry F. Nephew,** vice-president—sales.

Woodbridge Plastics Inc., Woodbridge, N. J., has been established to provide custom compounding of vinyl and polyethylene for the wire and cable, vinyl shoe, profile extrusion, and injection molding industries. **Kenneth B. Cary** is president and **Richard A. Murphy,** vice-president—sales.

Expansion

Northern Industrial Chemical Co., Boston, Mass., has acquired the entire **Dinnerware Div.** of **The Watertown Mfg. Co.,** Watertown, Conn., molder of melamine dinnerware, according to a joint announcement. Watertown will continue its material and custom molding operations. **George N. Wilcox** of Watertown's dinnerware division will continue as sales manager with Northern, and the same sales representatives will handle the line.

Lenox Inc. has formed a wholly owned Mexican subsidiary, **Compania Internacional de Plasticos Lenox, S.A. de C.V.** in San Bartolo Naucalpan, Mexico, for the manufacture of melamine dinnerware and allied products. Construction of the plant, located just outside of Mexico City, has been completed and manufacturing is scheduled to begin in February, 1961. **Roy L. Caple** has been named vice-president and general manager, and **George Barranco,** sales manager.

Johnson Mfg. Co., Chippewa Falls, Wis. manufacturer of plastic extrusion equipment, has added 5000 sq. ft. of floor space to its present building. Total operational space now exceeds 12,000 sq. feet. This expansion includes increased office space, new engineering facilities, larger shop, and additional equipment.

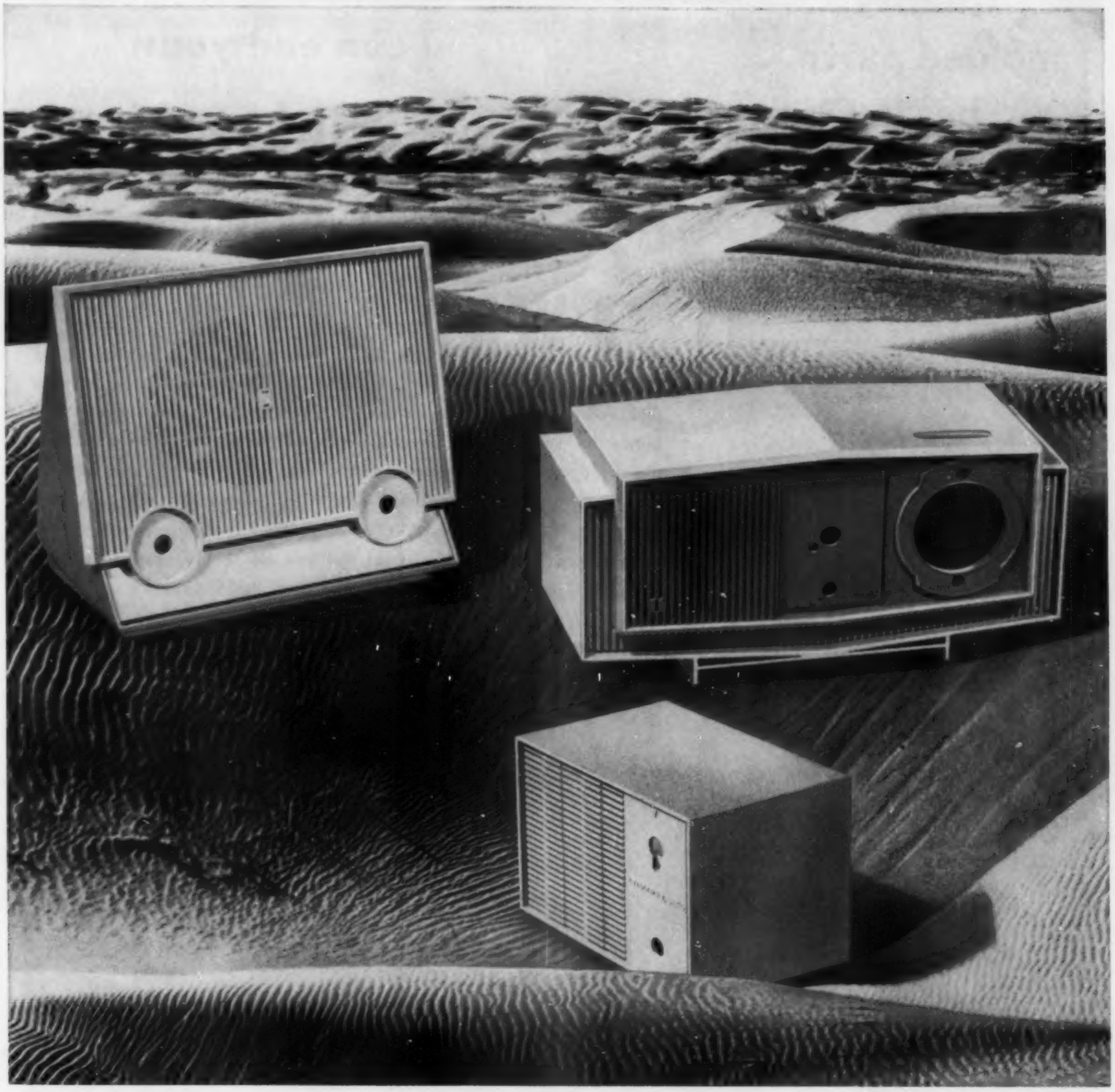
Monsanto Chemical Co. plans construction of a new plant in the Texas City, Texas, area for the manufacture of 50 to 75 million lb./yr. of phenol. The new facility will be Monsanto's third for phenol production, boosting its total capacity to over 200 million lb., and is scheduled to be on stream in the spring of 1962. Phenol is used as a chemical intermediate in production of resinous molding compounds, adhesives, surface coatings, and other organic syntheses.

Owens Plastics Co., a division of **Owens Metal,** Kansas City, Mo., has more than doubled its production facilities with the installation of new blow-molding equipment. Prior to its entry into the blow molding field, the firm has been producing custom extruded shapes for industrial applications. With the new equipment Owens can produce blown items ranging in size from small carboys for the chemical industry to 55-gal. containers that have a variety of uses.

Reichhold Chemicals Inc. has announced plans to expand its Jacksonville, Fla. facilities to include a 10-million-lb./yr. combination unit for the production of polyester and alkyd resins. To be built at the cost of approximately a half-million dollars, the unit will include the sixth polyester facility to have been added by Reichhold during the past five years. Two, completed this past year, are at its Tacoma, Wash., and Houston, Texas, plants. Other facilities are located at Detroit, Mich.; Elizabeth, N. J.; and Azusa, Calif.

Commercial Plastics & Supply Corp. of Florida has acquired **Florida Boat Shield Co.,** Starke, Fla. manufacturer of plastic windshields for small boats, and acrylic floor pads for **(To page 263)**

This new plastic gives radios a strong case against heat!



Koppers has developed a new high heat resistant material . . . DYLENE® 9 polystyrene . . . a natural for radio cabinets. This new formulation was developed to meet industry's need for a material with increased heat resistance. The radio cabinets pictured above are molded of this new plastic, and they've passed rigid oven tests.

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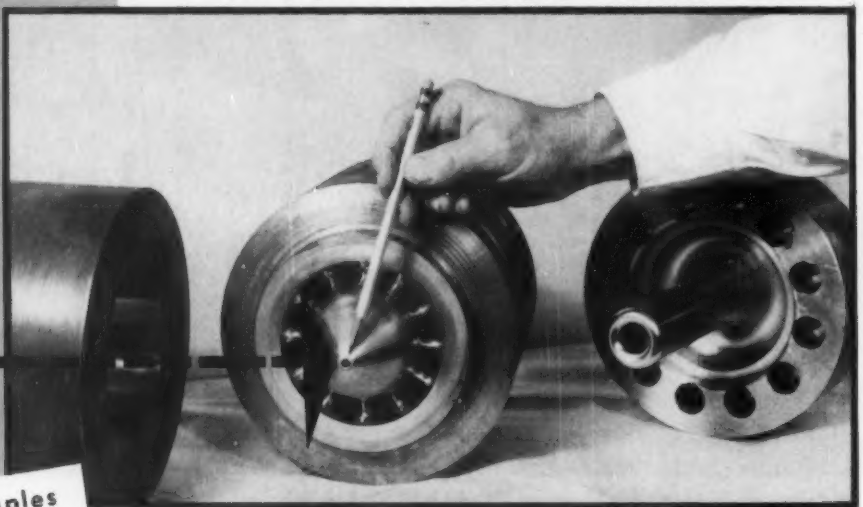

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(From page 260)

protective use under desks and chairs. **Joseph Arnold** continues as manager of Florida Boat.

Sheffield Plastics Inc., Sheffield, Mass. producer of extruded plastic shapes and sheet for lighting applications, is constructing a new one-story building which will house new and existing production equipment. Completion of the new wing is expected by December of this year with occupancy immediately thereafter.

Fasson Products, a division of **Avery Adhesive Products Inc.,** Painesville, Ohio, has installed a block-long coating and laminating machine in a new 18,000-sq.-ft. extension to the plant area. With the addition of the machine, Fasson Products has now doubled its plant capacity.

Seiberling Rubber Co., Plastics Div., Newcomerstown, Ohio, has installed a calender, weighing more than 100 tons, which will double production of the division's line of rigid thermoplastic sheets. The new installation is part of the current expansion which was started in 1959. The program will be completed later this year with the addition of more equipment.

Dormeyer Corp., Chicago, Ill., has acquired **Camfield Fiberglass Plastics Inc.,** Zeeland, Mich. reinforced plastics molding firm.

S. Curtis & Son Inc., Sandy Hook, Conn. packaging firm, has acquired **Valley-National Corp.,** Milldale, Conn. producer of thermoformed plastic packaging and packaging components, through an exchange of stock. Valley-National will be operated as a wholly-owned subsidiary of Curtis.

Allied Chemcial Corp. has announced plans for construction of 50,000 sq. ft. of additional building space at its property near Morristown, N. J., which will include three new structures: a two-story research laboratory, a two-story process **(To page 264)**

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laboratory, and a one-story chemical warehouse and garage. Completion of the buildings is expected by June, 1961. At present Allied Chemical's Morristown site contains six buildings operated by the company's Central Research Laboratory and its General Chemical Division.

Enjay Chemical Co., a division of **Humble Oil & Refining Co.**, has completed facilities at the Bayway Refinery, Linden, N. J., for the production of acetone in excess of 100 million lb./yr. Acetone is used primarily as a solvent and as a chemical raw material for resins, plastics, and other chemical intermediates.

Enjay has also announced a 60% expansion of its Baton Rouge, La., benzene plant. Styrene and synthetic phenol—raw materials for rubber and resin—use well over half of the current benzene capacity.

J. B. Carroll Co., Chicago, Ill. fabricator of thermoplastic sheet materials, has been merged with **Dashew Business Machines Inc.**, Los Angeles, Calif. manufacturer of business data writing equipment as well as card punching equipment.

In addition to its production of plastic calculators, laminations, special rulers, etc., J. B. Carroll Co. manufactures great quantities of precision credit cards for the Dashew organization.

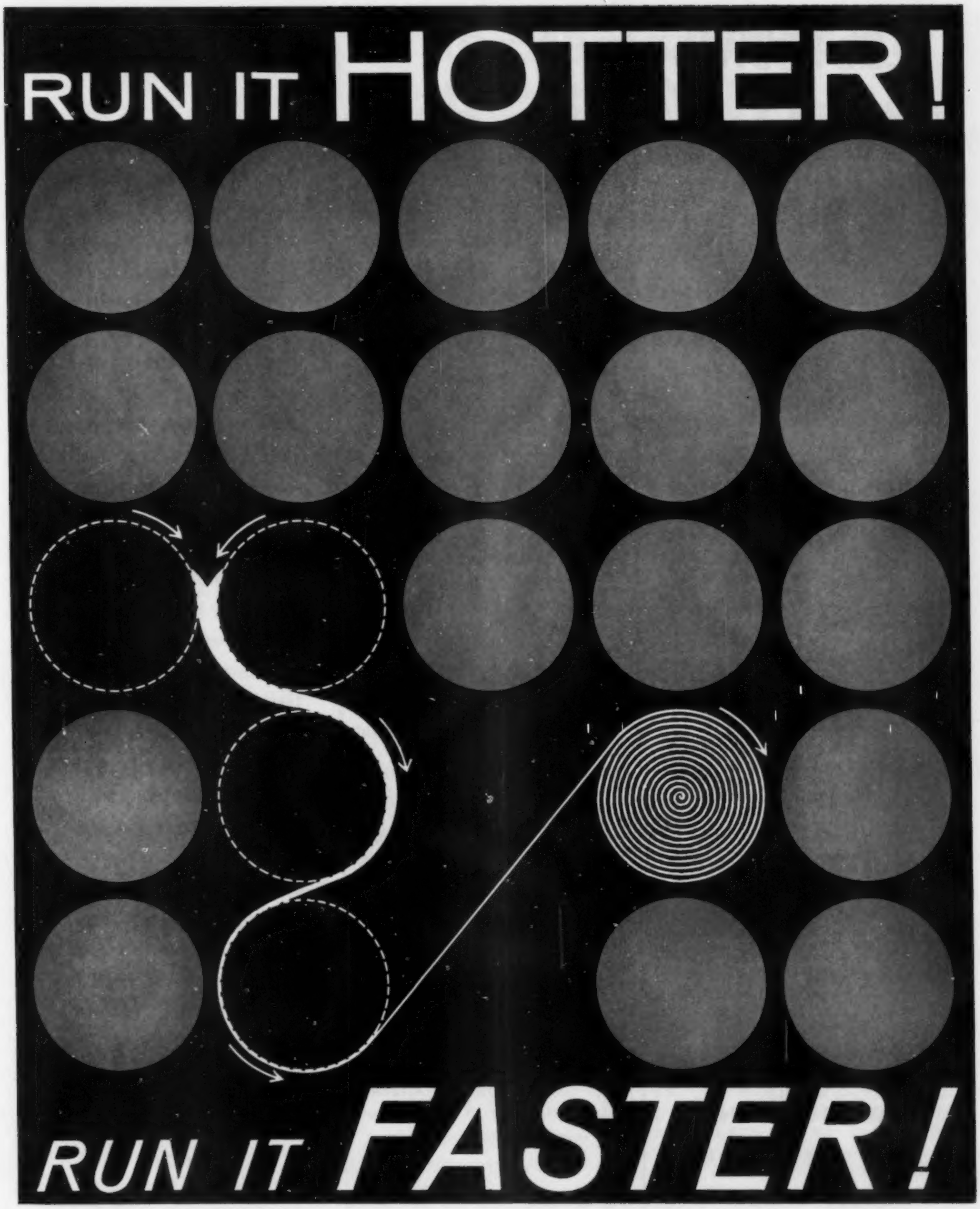
Foster Grant Co. Inc., Leominster, Mass., will construct its planned multi-million-dollar polyethylene plant in Beaumont, Texas, adjacent to the **Mobil Chemical Co.** ethylene plant. Completion is scheduled for mid-1961. **Joseph C. Foster**, president, stated that Foster Grant and Mobil Chemical "will work together on the development of high-pressure polyethylene and applications which would be of mutual interest." He said that long range plans for the plant include polymerization and copolymerization of propylene, butylene, and other hydrocarbons. Polyethylene will be the fifth major resin to be produced by Foster Grant. The others are general-purpose and high-impact polystyrene, nylon-6, and styrene acrylonitrile. The company also makes styrene monomer at its Baton Rouge, La., plant.

Northern Plastics Corp., La Crosse, Wis. manufacturer of plastic laminates for the electrical and electronics industries, is constructing a 17,000-sq.-ft. plant in Vernon Industrial Park, near La Crosse, for the manufacture of decorative laminates for the building and furniture industries.

B. F. Goodrich Chemical Co. has begun production of vinyl resins and compounds at its new plant in Long Beach, Calif. This is the Cleveland-based company's first plant west of the Mississippi. The automated plant will employ about 40 persons when all compounding and warehouse facilities are operating. Vinyl monomer, the raw material from which the company's Geon vinyls are made, is obtained from the petrochemical plant of **American Chemical Co.** located near the new BFG Chemical plant.

Du Pont de Nemours (Nederland) N.V. plans construction of a new plant in Dordrecht, The Netherlands, for processing Delrin acetal resin for use by the entire western European market. Construction of the plant, reportedly the first of its kind in Europe, will start immediately, and production operations are scheduled to begin in 1962. It will include facilities for extrusion, cutting, packaging, and shipping of Delrin. The Dordrecht plant will finish and color Delrin polymer produced at the parent company's plastics plant in Parkersburg, W. Va. Sales will be the responsibility of **Du Pont de Nemours International, S.A.** in Switzerland through its various distributors.

Owens-Corning Fiberglas Corp. has completed a multi-million dollar Technical Research Center at Granville, Ohio. The new facility consists of seven research and test buildings with 154,000 sq. ft. of floor space and employs 250 scientists, en- **(To page 266)**



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ADVANCE

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gineers, technicians, and administrative personnel. (This is in addition to the 400 research people working at other Owens-Corning facilities.)

Among major projects currently under study are acrylic-glass panels — which Owens-Corning is now test-marketing in several territories; resin-impregnated fibrous glass structural members that can serve as floor joists—in one test installation, a floor laid down on a sandwich made of this material extended over an unsupported span of 16 ft.; ceilings made of the same material, which act like acoustical tiles without producing the tile pattern; absorption pads for use under machinery that almost completely eliminate vibration and permit quieter-running and more efficient operations.

Needless to say, Fiberglas is used in profusion on both the outside and inside of buildings; for wall panels, insulation, light panels (including flake), ducts, air filters, furniture, etc. A considerable amount of work is being done on basic problems, such as the question of what happens at the surface of the glass when used as a reinforcement. This has led to development of new coupling agents (used in the joist members mentioned above), which improve strength properties of the composite material. Another recent development is a fiber with largely increased modulus, opening up a whole new group of markets.

Deceased

Donald F. Fraser, 47, vice-president—manufacturing of **Garlock Inc.,** Palmyra, N. Y., died Sept. 12 of a heart attack.

Meetings

Plastics groups

Nov. 30-Dec. 2: British Plastics Federation, 2nd International Reinforced Plastics Conference, Cafe Royal, London, England.

Dec. 10: The Society of the Plastics Industry, (S.P.I.), Midwest

Section Christmas Dance, Edgewater Beach Hotel, Chicago, Ill.

Jan. 24-27, 1961: Society of Plastics Engineers Inc. (S.P.E.) Baltimore-Washington Section, 17th Antec, Shoreham Hotel, Washington, D. C.

Feb. 7-9: S.P.I. 16th Reinforced Plastics Division Conference, Edgewater Beach Hotel, Chicago, Ill.

April 12-14: Deutsche Kunststoff-Tagung, Berlin, Germany.

June 5-9: S.P.I. 9th National Plastics Exposition and National Plastics Conference, Coliseum and Commodore Hotel, New York, N. Y.

June 9-17: European Congress of Chemical Engineering and ACHEMA Congress and Exhibition, Frankfurt am Main, Germany. Simultaneously, and in the same city, will be held the 15th Meeting of European Federation of Corrosion.

June 21-July 1: Interplas 61, 6th International Plastics Exhibition and Convention, Olympia, London, England.

July 27-Aug. 1: International Symposium on Macromolecular Chemistry, Queen Elizabeth Hotel, Montreal, Canada.

Other groups

Nov. 30-Dec. 2: 9th Annual Wire and Cable Symposium jointly sponsored by U. S. Army Signal Research and Development Laboratory and industry, Berkeley-Carteret Hotel, Asbury Park, N. J.

Dec. 2: Akron Polymer Lecture Group, "Single Crystals and Folding of Macromolecules," Room 107, Knight Hall, University of Akron, Akron, Ohio.

Dec. 12-15: 1st Industrial Building Exposition and Congress, also concurrent Conference Sessions, including "New developments in application of plastics to construction," Coliseum, New York, N. Y.

Jan. 16-20, 1961: National Housewares Mfrs. Assn. 34th National Housewares Exhibit, McCormick Place, Chicago, Ill.—**End**

COMPANIES . . . PEOPLE

Appointments, promotions, and relocations in the plastics industry.

Monsanto Chemical Co.: Howard K. Nason, formerly v-p and gen. mgr., Research and Engineering Div., elected pres. of the newly formed **Monsanto Research Corp.**, a wholly owned subsidiary. **Donald J. Miller** appointed product administrator—polyethylene, **Plastics Div.**, Texas City, Texas. **C. Howard Adams** appointed mgr. product engineering and **Michael F. X. Gigliotti**, asst. dir., engineering, **Plastics Div.**, Springfield, Mass.

Formica Corp., subsidiary of **American Cyanamid Co.: Albert L. Munsell** named gen. sales mgr.; **S. J. Cartier** named industrial sales mgr.

Santay Corp., Chicago, Ill. custom molder: **R. L. Jacklin** named sales mgr.; **Vern James**, sales mgr., new products div.; **Clifford Cox**, production mgr.; **William Szepi Jr.** is in charge of engineering. **Daniel Mackessy** appointed operational mgr. of **Santay Eastern Inc.**, a new plant established by the company in Syracuse, N. Y.

Standard Ultramarine & Color Co., Huntington, W. Va. producer of pigments for plastics and other industries, moved its New Orleans, La. office to 868 York Ave., S. W., Atlanta, Ga.

F. J. Stokes Corp., Philadelphia, Pa., established within its Press Div. a new Packaging Equipment Dept. to concentrate on production machinery for package-type products, particularly those made of plastics materials. **Larry C. Morehouse** heads the new dept.

Robert Fehr and **Charlton I. Prince** appointed sales engineers in the Rochester, N. Y. dist. office.

Tower Packaging Co., extruders, converters, and printers of polyethylene film, moved from Skokie, Ill., to a new and larger plant in Wheeling, Ill., a suburb of Chicago.

Industrial Printed Parts Corp. is the new name of **Charles W. Goudie Co.**, Royal Oak, Mich. fabricator, printer, and decorator of plastic, metal, and glass parts.

T. V. Jay Co., designer and mfr. of electroformed molds and spray masks, moved from 2227 W. Belmont Ave. to new facilities at 1771 W. Sunnyside, Chicago, Ill.

Catalin Corp. of America: Edward W. Bastian, v-p, appointed gen. sales mgr. He will be responsible for sales in all product lines and will headquarter in the New York, N.Y. exec. office. **A. D. Veale** named Midwestern dist. sales mgr.; will headquarter in Chicago, Ill.

Union Carbide Corp.—Union Carbide Plastics Co.: Arthur E. Irvine appointed mgr.—flexible packaging materials. He has been with the company since 1935, and was most recently group leader in the company's Development Dept., responsible for polyethylene film and extrusion coating materials. **D. W. Tighe** named office mgr., Boston, Mass., dist. sales office.

A. E. Irvine

Union Carbide Chemicals Co.: Richard F. Brown appointed v-p—sales; **Robert L. Duncan**, v-p—product marketing; **Thomas R. Miller**, v-p—R & D; and **Arthur P. Moss**, v-p and works mgr.

Visking Co.: L. J. Sinnott named gen. mgr., special products. The new special products group will handle Visqueen polyethylene films used in building, agricultural, laundry, and dry cleaning fields.

Ellison Machinery Co., Los Angeles, Calif., distributor for plastic injection molding machines of **National Automatic Tool Co.**, Richmond, Ind.: **Charles M. Letz** appointed v-p, gen. mgr.; **J. O. Ellison**, owner, elected pres., but continues as pres.-active mgr. of **Harron, Rickard & McCone Co.**, San Francisco, Calif. area Natco distributor.

Rohm & Haas Co.—Plastics Sales Dept., Philadelphia, Pa.: **Allan J. Spilner** returns from Los Angeles plastic sales group to home office as product mgr., molding powder sales; **Walter G. Lee**, formerly field rep. in Dayton, Ohio, named product mgr., Plexiglas sheet sales.

Goodyear Tire & Rubber Co., Films & Flooring Div.: K. L. Weeden, former north central dist. mgr. in Cleveland, Ohio, appointed mgr., flooring sales in Akron, Ohio. He is succeeded by **P. E. Mulvehill**, formerly south central dist. mgr. in Dallas, Texas. **C. R. Denbrock**, Akron packaging films converter sales, replaces Mr. Mulvehill in Dallas. Also advanced are **D. L. Hart** to vinyl film sales mgr., and **J. J. Tiernan** to packaging films sales development mgr. Both have Akron headquarters.

Space Products Inc., Waconia, Minn., a recently formed subsidiary of **Space Structures, Inc.**, Chanhassen, Minn., will concentrate on manufacture of plastic products requiring large molds, starting initially with compact boats but including such items as closed containers and tanks of various sizes. These will be processed by Thermofusion, a European-developed method for low-cost fabrication through the use of inexpensive molds.

Newark Die Co. Inc., Newark, N. J., designer and mfr. of dies, molds, hobbings, and castings for the plastics industry: **Nathan M. Miksch** elected pres.; **Victor P. Bergquist** appointed plant mgr.

Hysol Corp., Olean, N. Y.: **Dr. Cataldo Cialdella** appointed dir., R & D; **James P. Hornburg** named supv., tech. services; and **Henry J. Markowski** joined the laboratory staff and is currently responsible for Hysol's product development program working on high heat resistance of epoxy resins.

Hull Corp., Hatboro, Pa., mfr. of Hull-Standard molding presses, established a sales and service engineering office at 20666 Beachwood Dr., Cleveland, Ohio. **Malcolm Adler**, who was formerly with F. J. Stokes Co., is mgr.

Eastman Chemical Products Inc., Kingsport, Tenn.: **Henry L. Ford** elected pres., succeeding **Dr. L. K. Eilers**, who becomes chrmn. of the board of directors.

D. L. Guilian named sales rep. for industrial and specialty chemicals in the New York area; and **C. B. DeGreen** will handle sales of low-molecular-weight polyethylene resins in the southeastern states, with headquarters in Atlanta, Ga., for the Chemical Div. of Eastman Chemical Products Inc.

Plastic Papers Inc., Hicksville, N. Y.: **Dr. William Mullen**, formerly plant mgr., named v-p—production; **Kenneth J. Rawson**, formerly gen. sales mgr., is now v-p—sales; **George S. Price** appointed dir.—research. The company is a laminator of polyethylene on paper.

Ray Products Inc., Alhambra, Calif., plastics products fabricator: **H. D. Howard**, former plant supt., named v-p; **B. W. Fishel** has been named sales mgr.

O'Sullivan Rubber Corp.—Plastics Div.: Ted T. Lewandowski appointed mgr., sales development in the Winchester, Va. offices; **Fred A. Tetor Jr.** named sales mgr., vinyl sheetings, with offices in Hawthorne, N. J.; and **B. James Manno**, asst. sales mgr., will work with **(To page 270)**

COMPANIES . . . PEOPLE

(From page 268)

Mr. Tetor in the N. Y. sales office and warehouse facility in Hawthorne. The N. J. facilities are a major distribution center for flexible vinyls used in ladies' handbag, bookbinding, and novelty industries in the N. Y.-N. J. area.

Modular Molding Corp., Trenton, N. J., custom molder of fibrous glass RP products, moved its Molded Products Div. to 171 Bear Tavern Rd., W. Trenton, N. J. The company also operates another plant in Burlington, N. J.

Modern Plastic Machinery Corp., Clifton, N. J., mfr. of extrusion and blow molding equipment: **Frederick J. Maywald** appointed v-p and gen. mgr.; **Leslie J. Kovach**, v-p in charge of blow molding; **Bruno V. Menegus**, chief engineer; and **Casper S. Gilbert**, sales mgr.

Interplastics Corp., supplier of thermoplastic compounding materials, moved its offices from 120 E. 56th St., New York, N. Y. to 76-11 37th Ave., Jackson Heights, N. Y. Plant facilities remain in Kearny, N. J. **Gerald F. Bamberger** is pres.

Koppers Co. Inc., Pittsburgh, Pa.: **John W. Pool Jr.**, sales mgr., Plastics Div., appointed a v-p in that Div. **Walter L. Bossart** has been named export product sales mgr. of the International Div.

Marbon Chemical Div., Borg-Warner Corp.: Richard Mundinger promoted to sr. coatings development chemist, research section. **Fred Schneider**, formerly with Firestone Plastics, in charge of plastic applications and evaluations. **Ralph M. Levine**, formerly with Vinyl Products Ltd., England, named group leader in charge of coatings and latices. **Dr. Wendell Moyer Jr.**, formerly engaged in research at Union Carbide, is group leader in exploratory research.

Mobay Chemical Co., Pittsburgh, Pa.; **William C. Foster** appointed tech. sales rep. for the southwestern states, supervising urethane chemical sales to foam mfrs. serving southern furniture markets. **Daniel V. Pompilio** transferred from the eastern dist. to Akron, Ohio.

General Dispersions Inc., producer of nylon dispersions and solutions for plastic, wood, metal, and fabric finishing, moved from Paterson, N. J. to its new plant at 55 La France Ave., Bloomfield, N. J.

Norton C. Wheeler Jr. appointed R & D mgr., **Davis-Standard, Div. of Franklin R & D Corp.**, Mystic, Conn. He will work primarily toward development of high-production systems for all types of plastics extrusion.

Francis E. Gruber, former v-p of Brown & Bigelow, appointed chief engineer for **Northwest Plastics Inc.**, St. Paul, Minn. producer of custom and proprietary parts for electrical, electronics, and appliance industries.

Durbin "Doc" Hunter elected v-p and gen. mgr. of **Plastics Corp. of America**, Stamford, Conn., a subsidiary of **The Richardson Co.**, Melrose Park, Ill. mfr. of polystyrene molding and extrusion resins.

Albert W. Ehlers, v-p, elected to the board of directors of **Polyplastex United Inc.**, Union, N. J. He heads the company's **Pan Laminates Div.**, St. Petersburg, Fla. producer of Royaltex wall covering and rigid decorative vinyl laminates.

George A. Jachimowicz named market research mgr. of the Dapon Dept., Chemicals and Plastics Div., **Food Machinery & Chemical Corp.** He will be concerned with diallyl phthalate resins and monomers and the newly introduced Daponite decorative laminates.

Edward W. May appointed Eastern dist. mgr. for **Naugatuck Chemicals, Div. of Dominion Rubber Co. Ltd.**, Montreal, Canada. He will be in charge of sales of plastic resins, rubber, and agricultural chemicals in Eastern Ont., Quebec, and the Atlantic provinces.

Richard W. Bendheim appointed to head the newly created Plastic Div. of **L. H. Butcher Co.**, subsidiary of **The Udylite Corp.**, Detroit, Mich. The company is West Coast rep. for **Reynolds Metals, Semet-Solvay, Durez Plastics, Olin Mathieson, Metal & Thermit, Wyandotte**, and others.

Eldon L. Hall named tech. supv., Plastics Dept., at **American Viscose Corp.**'s Fredericksburg, Va. plant.

Joseph W. Brown appointed field sales rep. with headquarters in Los Angeles, Calif., for **Geigy Industrial Chemicals**, div. of **Geigy Chemical Corp.**, mfr. of U. V. absorbers, bacteriostats, etc.

Joseph W. Abraham named tech. dir. for **Isochem Resins Co.**, Providence, R. I. He will be responsible for research and development of epoxy resin formulations as well as allied products.

William E. Donovan appointed dist. sales mgr. in Eastern N. Y. and New England for **Fasson Products**, div. of **Avery Adhesives Products Inc.**, Painesville, Ohio, mfr. of self-adhesive papers, foils and films.

W. W. Clark named special asst. to gen. mgr., **Continental Oil Co.**'s petrochemical dept. and also will serve as asst. to chrmn. **(To page 272)**

FROM START TO FINISH YOU'RE IN SKILLED HANDS AT COMMERCIAL DECAL

Skilled hands help you design your patterns. Skilled hands produce the almost flawless melamine foil. Skilled hands help your technical people use them most efficiently. Skilled hands and trained minds produce in volume, deliver on time when you do business with Commercial Decal. For details, write or phone today: Commercial Decal, Mount Vernon, New York.

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COMPANIES . . . PEOPLE

(From page 270)

of the board of **Carlton Products Inc.**, Aurora, Ohio, a Conoco affiliate. He will perform liaison duties for Conoco with Carlon Products, producer of plastic pipe, and will headquarter in Aurora.

Norbert H. Kirchgessner appointed production supt., chemicals, **Durez Plastic Div., Hooker Chemical Corp.**, N. Tonawanda, N. Y. He succeeds **Jay P. Eggert**, recently promoted to works mgr. of the Div.'s new multi-million-dollar synthetic phenol plant now under construction near South Shore, Ky.

Burton E. Snyder appointed sales correspondent for **Synflex Products Div., Samuel Moore & Co.**, Mantua, Ohio mfr. of nylon, PVC, and polyethylene tubes and hoses.

Paul M. Reilly appointed sales rep. in the New York metropolitan area for **Vinyl Plastics Inc.**, Sheboygan, Wis. mfr. of vinyl flooring.

Lloyd C. Adam, formerly with Erie Engine & Mfg. Co., has been named manager of the **Rubber and Plastics Machinery Div., Taccone Corp.**, North East, Pa.

New reps.

William Brand-Rex Div., American Enka Corp., Concord, Mass., appointed newly formed **Wasson-Gallagher Co.**, 1024 N. Blvd., Oak Park, Ill., sales rep. in Chicago, Northern Ill., and Wis. for Turbo wire, cable and tubing products; and **Huse-Liberty Mica Co.**, Peabody, Mass., stocking distributor in New England for Turbo extruded and coated insulated tubings, zipper tubings, and Teflon wires . . .

Meyer Materials Inc., 4015 Millersville Rd., Indianapolis, Ind. appointed distributor for fiber glass roving and chopped strand mat by **Johns-Manville.** In addition to J-M products, Meyer Materials handles polyester and epoxy resins, catalysts, colors and extended pigments. . . .

R. B. Birge Co., 22 Webster Ave., Bridgeport, Conn., named master stocking distributor in Conn. for **Synflex Products Div., Samuel Moore & Co.**, Mantua, Ohio.

Corrections

"Progress in styrene-acrylonitrile copolymer," (MPl, Cct. 1960, p. 93): Correct designation for styrene-acrylonitrile materials produced by Foster Grant Co. Inc. is Fostacryl.

"How to extrude plastisols" (MPl, Oct. 1960, p. 131): In last column of Table II, formulation—"Pump-fed plastisol"—should be *A*.—**End**

Hit this New Sales Jackpot with VACUUM METALLIZING

Dramatic taillight lens of the Ford Thunderbird utilizes vacuum metallizing on inside surfaces.

Metal rim effect created through metallizing on instrument panel on Bonanza Airplane by Beechcraft made by metallizing.

New light weight metallized plastic arm rest on Pontiac, Buick and reflector on rear arm rest of Chevy's Impala, are less expensive than metal, look better.

Help Detroit win the battle against costs and weight and you'll bring home the sweetest slice of business you ever saw! And you can do it with vacuum metallized plastics!

Take a peek at the Mercury or Thunderbird taillights, the new arm rests for the Buick and Pontiac, or the smart backup plate on the Impala arm rest and see if these examples don't stimulate your imagination. It may also be worth your while to look over the instrument panel or aircraft interiors and chalk up another market with boundless opportunities for sales.

Best of all, you don't have to know anything about vacuum metallizing to get started. Buy the equipment from us; we will install it, train your operators, and help you set up a production operation.

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CLASSIFIED ADVERTISEMENTS

EMPLOYMENT • BUSINESS OPPORTUNITIES • USED OR RESALE EQUIPMENT

Machinery and Equipment For Sale

FOR SALE — SPROUT-WALDRON 335 cu. ft. Unused horiz. ribbon blender. Sturtevant #9 150 cu. ft. unused rotary blender. Baker-Perkins #15-UUMM 100 gal. Dispersion blade mixer, jkt., 100 HP, cored blades, comp. cover. Stainless Reactors or Resin Kettles: 3500, 1900, 750, 500 gal. jktd. and agit. Perry Equipment Corp., 1429 N. 6th St., Phila. 22, Pa.

FOR SALE—200 ton H.P.M. Downstroke Press 48" x 36" platens. Watson-Stillman 240 ton, ten 24" x 56". W. & W. 200 ton 24" x 42". Stokes Standard 50, 100, and 150 ton, Semi-Automatics. D & B. 150 ton, 25" x 25". French Oil 120 ton self-contained. 120 ton Upstroke, 29" x 21", 10" stroke. 60 ton Farquhar, 50" x 50", 30" stroke. Stokes 50 ton Birdsboro 24" x 20". Stokes 15 ton automatic. Hydraulic pumps and accumulators. MPM 3½ Wire covering Extruder. New ¾" Plastic Extruder. Other sizes up to 6". Seco 6" x 12" and 8" x 16", 2-Roll Mills and Calenders and other sizes up to 60". 60" Spreader Heads with XP motors. Despatch electric heated ovens and other types. New ¾ oz. Bench Model Injection Molding Machines. Van Dorn 1 and 2 oz. Other sizes up to 100 oz. Baker-Perkins and Day Jacketed Mixers. Taylor-Stiles Pelletizer, 7½ HP. Plastic Grinders. Stokes RD3 and R Machines. Send for listings. We Buy Your Surplus Machinery. Stein Equipment Company, 107 8th Street, Brooklyn 15, New York, STerling 8-1944.

FOR SALE — 2 CUMBERLAND 14" Notched-Knife Dicing Machines, each with 20 H.P. 1800 R.P.M. 3/60/220/440 motor, V-Belt drive, pivoted motor base. 2 Robinson Choppers size #1624, one without motor, one with G.E. Tri/Clad induction motor 220/440 V, 3 P, 60 C, 1760 R.P.M. All in good condition. Reply Box 6725, Modern Plastics.

FOR SALE—FIBERGLASS SPRAY UP SYSTEM — Chrom-o-lite wall mounted boom, pumps, valves & hoses. Peterson gun and two glass choppers. All complete —used 10 hours—customer cancelled boat contract. Schramm, 1126 Holly Ct., Oak Park, Ill., Eu 6-9013.

FOR SALE—BANBURY MIDGET mixer; 1-Farrell Birmingham 8" x 16" Chrome Plated 2-Roll Mill; 1-Baker-Perkins 10 gal. 304 SS Sigma Blade Mixer; 1-Baker-Perkins 100 gal. Sigma Blade Mixer; 1-Baker-Perkins size 16 TRM 150 gal. double arm Vacuum Mixer; 1-No. 1 Ball & Jewell Rotary Cutter; 2—Mikro Pulverizers, SS Bantam, #1 SH. 6—Stokes Model DD2, DS3, D3, and B2 Rotary Preform Presses, partial listing; we purchase your surplus. Brill Equipment Co., 35-65 Jabez St., Newark 5, N. J. Tel: MArket 3-7420.

FOR SALE — 3 PLASTIC INJECTION Molding Machines, $1000.00: 9 oz. HPM Model 250 H9, Ser. No. 45-517; 9 oz. HPM Model 250 H9, Ser. No. 49-9; 24 oz. 1945 Watson Stillman, Model Y3296. Call or write: National Products Company, BEnton 1-7811, 6100 Wilson Ave., Kansas City, Missouri.

FOR SALE—UNUSED HARTIG 3½" 20:1 Extruder, still in O.E.M. package. Complete controls, conveyor, water tank and drive base but without drive. Box 6729, Modern Plastics.

FOR SALE: Carver Press 1955 Model 16605-23, 20 Ton Press. Best offer over $150.00. Write, call or phone: John L. Armitage, 245 Thomas Street, Newark 5, N. J., MA 3-6010.

WHEELABRATOR PLASTIC DEFLASHERS for sale: 20x27 Tumblast, 27x36 Tumblast and No. 1 Multi-table complete with dust collectors, control panels, p.b. stations. Guaranteed to be in like-new condition. Ideal for deflashing of all plastic parts. Universal Machinery & Equipment Co., 1630 N. 9th St., Reading, Pa., FRanklin 3-5103.

FOR SALE—1 Stokes standard 50 ton self-contained transfer molding press model 258-A; 1 Baldwin Southwark 150 ton self-contained molding press; 2 Dunning & Boschert 300 ton molding presses; 1 Cumberland 7" stair step dicer, stainless steel; 2 Ball & Jewell granulators #1, #½. CHEMICAL & PROCESS MACHINERY CORP., 52 9th Street, Brooklyn 15, N.Y., HY 9-7200.

FOR SALE—Complete Melamine Compounding Department, consisting of Patterson 250 gallon jacketed steel ball mill, Defiance #20 preform press, Fritz mill. Inspect in operation. Reply Box 6730, Modern Plastics.

WE HAVE FOR SALE—1 set of embossing rolls, H. W. Butterworth & Sons; 3 rolls—one 14" dia; 2 steel (smooth & grain); Power—chain drive 46:1 reduction, 14 ton pressure. Suitable for take off on plastic sheet. New price $6000.00. 2 yrs. old. Any offer welcomed. Reply Box 6731, Modern Plastics.

INJECTION MOLDING MACHINES—48 oz. HPM with preplasticizer, new 1954. Two 24 oz. Watson Stillman Injection Molding Machines with preplasticizer, shoot to 100 oz. 22 oz. Reed Prentice, 12 oz. DeMattia, 12 oz. Reed Prentice, 8 oz. Reed Prentice also available. 300 Ton Stokes Transfer Molding Press, completely self contained with automatic control, motor and pump. 100 ton and 150 ton sizes also available. Scrap grinders, 1½ Cumberland, ½ Ball & Jewell, ⅓ Cumberland, DeMattia, and Abbeys also available. Up to 10 HP sizes. Hartig, and Royle 3¼ Extruders, NRM 2½" Extruder and JMC 1½" long barrel extruder. LaRose and Girdler Electronic PreHeaters. Stokes Model R and Colton Single Punch Tablet Presses. Complete line of mixers, blenders, tumbling barrels, mills, etc., for the plastic and rubber industry. We will finance. Johnson Machinery Company, 90 Elizabeth Avenue, Elizabeth, N. J., EL 5-2300.

EXTRUDERS — MPM 1½", NRM 2½", Electrically Heated; Royle No. 2, No. 3; Adamson 8" Strainer Head. Injection Machines—Moslo 4 oz. Universal Full Automatic, Reed-Prentice 16 oz. Presses—Stokes-Standard 150 ton, Bar Controls. Others 10 tons to 1500 tons. Scrap Cutters, Preheaters, Tablet Presses, etc. HOCHMAN PLASTICS MACHY. CORP., 151-P Mulberry St., Newark, N.J. MItchell 3-8430.

FOR SALE — COMPLETE MOLDING PLANT—Compression Presses, Hardinge 250 ton, Stokes—Standard 200, 150 ton—all self-contained, electric heating, automatic cycle, electric eye and mold closure safety controls. Preform Presses: Stokes RDS-3, RB-2, BB-2, DD-2. Tumbling barrels, etc. Excellent condition. Inspect under power. Russell Krahnert, 119 East 22 St., Brooklyn, N. Y. INgersoll 9-1416.

FOR SALE — PRESSES — IMMEDIATE DELIVERY—(1) EEMCO 175 ton 33" x 36" Downacting 60" Daylight 48" Stroke, (1) EEMCO 250 ton 36" x 60" Downacting 48" Daylight 36" Stroke, (1) EEMCO 350 ton 36" x 36" Upwardacting 24" Daylight 24" Stroke. All three units complete with self contained pumping units for speeds to 400 IPM—Never Used. Reply Box 6733, Modern Plastics.

FOR SALE—One (1) 175T Reed Prentice 4-6 ounce machine—with—extras—best offer—no dealers. Meteor Manufacturing Corp., Emporium, Pennsylvania.

FOR SALE—TWO REED PRENTICE Inj. Molding Machines, Model 10D—12 oz. (1954) complete with instruments, controls etc., for immediate removal. Both machines are in excellent condition, and priced reasonably. Call, write or phone for appointment to see in operation before removal. Ask for John Krach. Rogers Plastic Corporation, West Warren, Mass., HEmlock 6-7744.

SUBSTANTIAL SAVINGS ON GOOD EQUIPMENT—(6) Stokes Self Contained Molding Presses 150 ton with 3 HP. Hydr. Pump system. (2) HPM Self Cont. 25 ton; 18" Stroke, 40" Daylt. (1) HPM Self Cont. 7 ton Press; 12" Stroke S.B. 450 ton Press with 36" x 36" Platens. F.B. Unused 2 Roll Mills; 14" x 30" Uni-Drives. 2 Roll Mills, 12" x 24" and 22" x 60". 3 Roll Calendar, 22" x 58" with accessories. Baker-Perkins Dbl. Sigma Arm, Jktd. Mixers to 300 gal. Day 150 gal. Jktd. MOGUL Mixer, Vac. Cover, 75 HP Brand New FALCON Dbl. Ribbon Mixers; all sizes Extruders: NRM 1½", Royle 2", Hyd. Strainer 15". Stokes Preform Presses (3) #280, (1) #252 Colton #5½ T Single Punch Tablet Press, Ball & Jewell Rotary Cutters (2) #2, (1) No. 1 Sprout Waldron Rotary Cutter 15 H.P. Inquire about the FMC Rental-Purchase Plan. FIRST MACHINERY CORP., ST. 8-4672, 209-289 Tenth St., Bklyn. 15, N.Y., Cable "Effemcy".

MOST MODERN PACKAGING AND PROCESSING MACHINERY, available at great savings. Baker Perkins, W. & P. and Day Double Arm Steam Jacketed Heavy Duty Mixers—25, 50, 75, 100, 150 and 200 gal. capacities. Day, Robinson 50 to 10,000 lbs. Dry Powder Mixers, Jacketed and Unjacketed. Also wood and enamel Day Imperial 75 gal. Double Arm Mixer, Sigma, Dispersion Blades. Mikro Pulverizers, Models Bantam, 1SH, 2TH, 3TH and 4TH. Fitzpatrick Models D, K-7 and K-8 Stainless Steel Comminuters. Stokes Models R, RB-2 and Eureka Tablet Machines. Colton 2RP, 3RP, 3B, 5½ T Tablet Machines. Stainless Steel Jacketed Mixing Kettles 100 and 150 gal. capacities. Robinson Stainless Steel Double Arm Mixer for dry and viscous materials Package Machinery, Hayssen, Scandia, Wrap King, Campbell, Miller Wrappers. Cartoning Machines—Ceco, Pneumatic Scale, Jones. Standard Knapp, A-B-C, Ferguson Carton Sealers. Filling Machines—all types and sizes. Union Standard Equipment Company, 318 Lafayette Street, New York 12, N. Y. Phone: CAnal 6-5334.

FOR SALE—LAB EXTRUDER—1" N.R.M. Bench model, ¾ H.P., 220/440 variable speed motor. Wheelco Control 0-6000. Complete with transformer, switches, & all wiring. Mounted on stand with steel base. Excellent running condition. Carver Corp., 119 Railroad Ave., Norwood, Mass.

FOR SALE—3300-TON TWENTY-DAYLIGHT Board Press, steam heated platens 12'6" x 4'6", with mechanical loaders and unloaders; self-contained pumping unit; excellent equipment fully reconditioned. Reed Brothers (Engineering) Limited, Repland Works, Woolwich Industrial Estate, London S.E. 18., Cables REPLANT London.

Machinery Wanted

WANTED TO BUY — Used laboratory sigma blade dispersion mixer, one pint working capacity. Used laboratory 2-roll rubber or plastics mill. WATERLAC FINISH CO., INC., 120 Andover Street, Danvers, Mass.

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WANTED—VACUUM-METALIZER: 66" Tank in good condition. Reply Box 6737, Modern Plastics.

Materials Wanted

WANTED: Acetate, Butyrate and Acrylic scrap. Any Quantity of Sheet Trim, Purgings, Reground. Claude P. Bamberger, Inc., Ridgefield Park, N.J., HUbbard 9-5330.

ACETATE SHEET SCRAP WANTED— Top prices paid for clear transparent acetate. Sheeting scrap. (No tri-acetate). Write: Davis Products, Dept. No. 5, Kearny, N. J. Phone: N. J.—WY-1-0980; N. Y.—BA-7-6421.

DESPERATELY NEEDED: ACETATE AND BUTYRATE sheet scrap. Also, buy all other thermoplastics. Write, Wire or Phone collect: Philip Shuman & Sons, 571 Howard Street, Buffalo 6, New York —TL 3-3111. Area Code 716.

Materials For Sale

FOR SALE—40,000 lbs. Lt. beige Cycolac reground, 10,000 lbs. shiny black E/C pellets, 20,000 lbs. jet black C/A reproc. pellets. Reply Box 6738, Modern Plastics.

Molds For Sale

INJECTION MOLDS FOR SALE—Baby Bath 28x18x7. Latticed Laundry Basket 19x14. Leather grained paper basket 12x11x8. Utility Basket 19x13. Trash Can 10 gallon. Rectangular Laundry Basket 25x16x10. Well built of prehardened steel. Excellent condition. Fast cycling. Alfred A. Rosenthal, 3 Park Row, New York 38, N.Y.

MOLDS FOR SALE—All in excellent condition, ready for molding housewares, containers and covers. Some are unused (duplicate), some are discontinued items. Will fit 8 and 12 oz. machines. Priced to move. Rogers Plastic Corporation, West Warren, Mass., Hemlock 6-7744.

Molds Wanted

WANTED — MOLDS FOR EXPORT for the fabrication of all types of ball point pens by extrusion and injection molding. Send samples specifications and prices to: Sovereign International Corp., 144 East 44th Street, New York 17, N.Y.

Help Wanted

"TOY CREATORS" WANTED — Prominent New York toy manufacturer seeks creative designers for newly established toy development and styling department. Unusual opportunity to become established with a progressive, growing company that encourages creative thinking in plastics, metals, wood, cardboards; and all associated manufacturing processes. Immediate employment with compensation based on experience and ability. Write full particulars to: Box 6718, Modern Plastics.

EXTRUSION COATING OPERATORS and other personnel. Experienced. Finest new equipment, excellent ground floor opportunity with top company. Located in the Greater New York area. Our employees know of this Ad. Write for interview to Box 6736, Modern Plastics.

PLASTICS ENGINEER—for large northeastern manufacturer to supervise the new product and process plastics development sections. Chemical or Mechanical Engineering Degree preferred. Must have a minimum of five years experience in molded and extruded plastics as related to pipe and fittings and possess managerial ability. Reply Box 6717, Modern Plastics.

CHEMIST OR CHEMICAL ENGINEER— To supervise development and materials applications of plastics materials and products in development and production laboratory. Midwest location. Reply Box 6720, Modern Plastics.

MECHANICAL ENGINEER—Challenging new opening with an expanding plastics department of The Borden Chemical Company. Applicant should be a graduate mechanical engineer with 8 or more years of solid experience in specifying, designing, and installing mechanical processing equipment. It is preferable that this experience be associated with the plastics conversion industry. Please submit details of background and salary requirements in confidence to: H. R. Erickson, Borden Chemical Company, 1 Clark Street, North Andover, Mass.

MOLD DESIGNER—Experienced injection, compression and transfer mold designer. Please forward detailed resume of personal history, experience, and salary requirements to: ABA Tool & Die Co., Inc., P.O. Box 75, Buckland, Conn.

ENGINEERS AND FOREMEN—Experienced with Vacuum Forming or Sheet Extrusion. The most progressive company in plastics has openings for top men in production and engineering. We are located in a beautiful suburb of a large city. Will make attractive offers to the right men. Reply Box 6726, Modern Plastics.

OPENING IN PLASTIC MATERIALS Applications Engineering. Degree in Chemical Engineering or Chemistry required. At least three years specification and design or equivalent heavy practical experience in thermoplastic and thermosetting molding techniques and materials necessary. Experience in adhesives and rubber technology desirable. Work to include in-company consulting service to design engineers to assist them with plastics problems. Liberal company benefits. Relocation expenses paid. Send resume to: R. J. Anderson, REMINGTON RAND UNIVAC, Division of Sperry Rand Corporation, Univac Park, St. Paul 16, Minnesota.

MECHANICAL OR TOOL ENGINEER wanted with B.S., M.E. or equivalent. Leading manufacturer of laminated plastics has excellent opportunity for experienced engineer qualified to assume responsibility for product design, quality control, tool and special machine design, and manufacturing methods. Modern plant, located in eastern Pennsylvania. Good living conditions. Send complete resume, references and salary requirements. Box 6728, Modern Plastics.

POLYESTER RESIN CHEMIST—experienced in formulation and application of resins for hand-lay-up, matched metal molding preform and premix. Salary commensurate with experience. Contact American Alkyd Industries, Carlstadt, New Jersey—Geneva 8-4332.

SALES MANAGER To head newly created Division of Extrusion Coated and Laminated Products. Outstanding opportunity with America's Oldest Bag Manufacturer. Individual must be experienced in this line and will have wide latitude in establishing and managing national organization. Excellent salary and other benefits. Plastics Division, Chase Bag Company, 355 Lexington Avenue, New York 17, N. Y.

CHEMICAL OR MECHANICAL ENGINEER—We have an interesting and challenging position available immediately in our Reading, Pennsylvania plant for a man with at least two years experience and training in the plastics industry. Background in the compounding of vinyls, epoxies or phenolics is desirable. Duties will consist of process development and production supervision. This position is in line with a revolutionary new coating method, and offers unlimited opportunities for advancement. Please send resume in confidence to: The Polymer Corporation, P.O. Box 422, Reading, Pennsylvania.

PROCESS ENGINEER—With experience in blown film extrusion, as well as Laminating and Coating Equipment. Unusual opportunity for talented individual in rapidly expanding plant. Variety of processes involved, including extensive new machinery installations. Excellent salary and other benefits. Chase Bag Company, 5033 Southwest Avenue, St. Louis 10, Missouri.

GENERAL FOREMAN, OPERATORS For Extrusion Coating and Laminating Operation. Rare opportunity to handle rapidly growing new Processing Department. Must have extensive experience. Will be working with latest model equipment. Chase Bag Company, 5033 Southwest Avenue, St. Louis 10, Missouri.

MANUFACTURERS REPRESENTATIVES to cover East Coast for expanding Florida custom injection molder. Presently molding highest quality precision parts from all thermoplastics. We will support you with prompt service, competitive prices, sales literature, and samples. Send resume to: Pearce-Simpson, Inc., Molded Plastics Div., P. O. Box 48-223, Miami 42, Florida.

ASSISTANT SUPERINTENDENT with solid knowledge of cello and poly printing and experience in poly bag making. Will take charge of expanding department in southern plant. This is a permanent growth opportunity with major national company. Salary and benefits commiserate with experience. Chase Bag Company, 4500 N. Dorgenois St., New Orleans, La.

MANUFACTURERS SALES AGENT for expanded polystyrene foam plastics Manufacturer—Molder of expandable polystyrene plastic. Serving O E M and packaging field with custom specified components and protective packaging parts seeks wider territorial sales representation. Our company is located in Chicago. Established over 15 years. Excellent following and reputation. We fabricate and mold Dylite, Pelaspan and Styrofoam Parts. We are especially interested in Representatives with a following in the Electronics, Instruments and Tool industry. Sensible compensation arrangement. Address Reply to: Box 6735, Modern Plastics.

ESSO RESEARCH & ENGINEERING is intensifying its activities in applications research and new petrochemicals development. A number of excellent research staff positions have been created in our Chemicals Research Division for Chemists and Chemical Engineers of all degree levels and with 2-6 years experience. THERMOSETTING RESINS: Compounding, formulation, and fabrication research on new thermosetting resins for such applications as glass and paper reinforced laminates, encapsulation and molding compounds. Work with new Buton resins in both laboratory applications and field contact with market development personnel. THERMOPLASTICS: Product and applications research on new thermoplastics, including polyolefins. Experience desirable in evaluation of new materials and techniques, operation of plastics processing equipment, compounding and testing of products for such fields as film, extrusion coating, pipe, wire coating, blow molding, flame spraying, and monofilament. Association with ESSO offers excellent opportunities for personal advancement, professional growth, publication of papers, and participation in technical society activities. Forward replies in complete confidence to Mr. C. D. Gardel, Professional Employment—Dept. V. ESSO RESEARCH & ENGINEERING CO., P.O. Box 175, Linden, N. J.

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Business Opportunities

PRESS TIME OPEN—We can mold your Fiberglas product for you using preform or mat technique. Press capacity up to 150 tons—36x48 bed. Contact J. B. Quinn, Brunswick Corporation, School Equipment Division, 2605 East Kilgore Road, Kalamazoo, Michigan.

PRESS TIME AVAILABLE—One 500-Ton compression moulding press with 30" opening, long term moulding wanted only. Write L & S Lampshade Mfg. Co. Inc., 449 Troutman Street, Brooklyn, N. Y. HY 7-4376-7

BUTTONS—Dutch company offers complete plant, formulae, chemical and technical know how, etc. for the production of polyester sheets with pearl effects for the button-industry. New development guarantees high and continuous production. Further information on request. Reply: Koop Lenstra, Ltd., Postbox 15, Aalten, Netherlands.

FOR SALE—Operating company in midwest, manufacturing reinforced plastics in aircraft and commercial fields. Fully equipped, necessary qualifications, excellent personnel, good location. Sizeable tax loss to carry forward. Reply Box 6734, Modern Plastics.

IMPORT, EXPORT, BROKERS and AGENTS. Lotz and Company, 109 Broad Street, New York 4, N. Y.

Situations Wanted

CHEMICAL ENGINEER: 34, twelve years diversified experience; thermoplastics calendering extrusion, and laminating; industrial coatings formulating; elastomers. Strong background in product and process development technical service, market development, sales promotion, production, administration. Patents. Currently employed AAAA Company in responsible supervisory position where opportunity is limited. Reply Box 6732, Modern Plastics.

PROBLEMS? PLANT MANAGER—Young, Aggressive, seven years experience. Thermosetting, Production, Purchasing, Cost-control, Management, Reinforced plastics field, sheet, small parts, spray. Desires responsible position. State salary range offered. Reply Box 6721, Modern Plastics.

SALES MANAGER—Attention extruders and blow molders. Want to diversify your line? Let me get you new o.e.m. products, custom shapes, expand existing lines. Reply Box 6727, Modern Plastics.

WEST COAST: Are you interested in opening a west coast branch for your manufacturing operation? Seasoned, capable, experienced man with exceptional ability in production and sales available 'on the spot.' Injection, compression, transfer, profile & film extrusion, and blow molding. Excellent innovator and organizer. Want to start, manage, and build your Coast operation. Location smaller Calif. town with space, labor, rail & truck facilities available. Salary completely secondary to opportunity and/or participation. Top trade and personal references. Write Box 6719, Modern Plastics.

BLOW MOLDING—Do you need manager to set up or run blow molding operation? If so write me. Experienced in industrial shapes and bottles, also profile extrusions. Can help with sales. Reply Box 6724, Modern Plastics.

Miscellaneous

CUSTOM MOLDING WORK WANTED—Well established injection and compression molding plant seeks additional business. Equipment includes injection press capacity up to 32 ounces and compression presses up to 200 Ton. Operates own tool shop. Plant located 200 miles from New York City. Reply Box 6723, Modern Plastics.

WANTED TO BUY—Interested in Purchasing all or Part of—Injection Mold-Making shop, in New England Area. Reply Box 6722, Modern Plastics.

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INDEX OF ADVERTISERS

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MODERN PLASTICS
A BRESKIN PUBLICATION
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extrusion plants
injection moulding machines
blow-moulding plants

EDITORIAL

International standards after ten years

The week of October 17th, in Prague, was held a meeting of Technical Committee 61 on plastics of the International Standardization Organization (ISO). An American team of 12 men joined with delegations from 20 other nations to continue the work of establishment of voluntary international standards for plastics.

The ISO Plastics Committee was established 10 years ago, largely inspired by the plastics industries in the U. S. In that decade, nine ISO recommendations for plastics have been established and 14 recommendations, already approved, await final action by the top ISO Council. Five more recommendations await review before finalizing. A total of 28 recommendations for effecting standardization of plastics nomenclature, definitions, properties, procedures, and specifications of importance to plastics industries in all countries are involved in these proceedings.

With plastics becoming more and more international in every aspect, from production through trade and processing, this Committee, by preparing the technological ground rules under which international trade in plastics shall be conducted, and by providing a common language for exchange of definitive technical information, is bound to facilitate the increase of foreign trade and the greater use of plastics in all lands.

With the establishment of the new "group markets" such as the European Common Market and the European Free Trade Association, and with others under development in various parts of the world, it becomes imperative that the technical language barriers be broken down. With plastics expositions and conferences all over the world, exposing end-user industries to our new materials, our new techniques and our advanced applications, the technical language barriers must be replaced by mutually understandable guideposts on the road to increased use of plastics.

The Plastics Technical Committee of ISO is doing that—and much more.

We wish the Committee and the Organization continued success in usefulness in the next decade.

Hiram McCann

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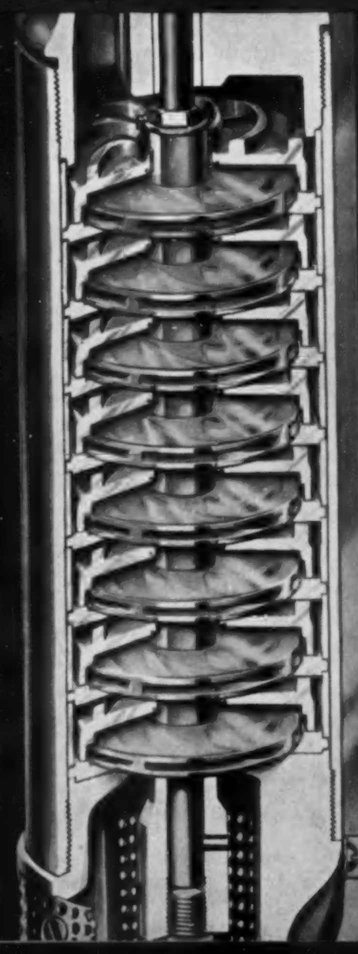

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